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Bell Telephone Magazine

A non-technical review, published quarterly to give Bell System management people a broader view of the history, objectives, operations, and achievements of this business than they might attain in the course of their day-to-day occupations, and an added sense of participation in the problems and accomplishments of our nation-wide public service.

Cover: "On the DEW Line"
Painted for this issue by *Robert Geissman*

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A MEDIUM OF SUGGESTION and A RECORD OF PROGRESS

JUDSON S. BRADLEY, *Editor* SALVATORE J. TAIBBI, *Art Editor*

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XUM

Who's Who & What's What

IN THIS ISSUE

FROM JANUARY TO MAY of this year, WILLIAM E. BURKE was project manager of Project 572, less formally known as the DEW Line, and therefore responsible for the management of the whole vast undertaking. He is, obviously, the logical man to describe its size and importance, and the problems which arise at every turn. Since May first he has been vice president of Western Electric's defense projects division—which includes his previous activity, of course.

Mr. Burke entered the Bell Telephone Laboratories in 1928, and in 1933 accepted a position with Consolidated Edison Company in New York. He returned to the Bell System in 1936 as an engineer in Western

William E. Burke

Hal S. Dumas

Electric's Kearny Works, and by 1947 he had become superintendent of manufacturing engineering there. In 1950 he went to the Point Breeze Works, and became assistant works manager two years later. He moved to Western's headquarters in New York in 1954 as manufacturing division comptroller, and the following year was made defense projects division comptroller.

In the preparation of his contribution to this issue, Mr. Burke had the expert assistance of George B. Turrell, Jr., feature editor of Western's *WE Magazine*, who toured the DEW Line installation with him last winter. Mr. Turrell has since written a description of his trip for *WE* and the booklet "The DEW Line Story," to which Western Electric is giving wide distribution. If there is a certain family resemblance among these pieces, it is undoubtedly be-

Sanford B. Cousins

cause they all derive from a single source: the DEW Line itself.

RETURNING to his beloved Southland on July 1, HAL S. DUMAS put an end to a Bell System career of 45 years which began in the Plant Department of the Southern Bell Telephone and Telegraph Company in Atlanta in 1911 and continued with that company for forty years—the last eight as its president. Then in 1951 he became executive vice president of A. T. & T.—the post from which he has now retired. To this MAGAZINE for Autumn 1952 Mr. Dumas contributed "The Telephone Engineer and His Job," and for Summer 1954 "Courtesy: One of Our Greatest Assets." In an article of four years ago describing the members of the A. T. & T. administrative group, this MAGAZINE said of Mr. Dumas that "System executives who seek his counsel find it flavored with ripe judgment."

"SERVING THE COMMUNITY—FROM ITS POINT OF VIEW" comes appropriately from the pen of A. T. & T.'s vice president in charge of Public Relations. SANFORD B. COUSINS has held that office since early in 1955—the most recent of many in a Bell System career which began with the Long Lines Department in 1920. Changing to the Traffic Department of the New York Telephone Company in 1921, he held a succession of positions in a variety of places which led to his appointment in 1940 as general traffic manager. Four years later he became an assistant vice president in A. T. & T.'s Personnel Relations Department. In 1948 he was elected vice president and general manager of the New England Telephone and Telegraph Company, and in 1950 to the like office of the Bell Telephone Laboratories. It was in 1952 that he became president of the Northwestern Bell Telephone Company — whence he came to A. T. & T.

WHEN EUGENE J. MCNEELY contributed the introduction to "Benefits and Pensions Have Proved Their Value for 40 Years" in this MAGAZINE for Summer 1953, he was A. T. & T. vice president in charge of the Personnel Relations Department. When he contributed the introduction to "Emergency Mobilization and the Bell System," just a year later, he did so as vice president in charge of the Department of Operation and Engineering. His present contribution comes from the pen of the executive vice

(Continued on page 128)

Eugene J. McNeely

Important portal: Entrance to the headquarters of the western sector of the DEW Line, Point Barrow, Alaska

The Bell System, working through Western Electric, is building and equipping the radar line which crosses the Arctic shore between two oceans.

THE DEW LINE: SENTINEL OF THE NORTHLAND

WILLIAM E. BURKE

Vice President, DEFENSE PROJECTS, WESTERN ELECTRIC COMPANY

IT MAY NOT BE the most arduous task since manpower alone built the pyramids in Egypt, nor the most venturesome undertaking since Columbus first set his course to the West; indeed, it may not be the single greatest contribution to America's peace and progress since V-J day. Yet many a telephone man will argue with you, out of his own hard experience, that this commitment to build a radar warning line clear across the very top of the continent, under the long night and the bitter cold of the Arctic circle, partakes in large measure of just those qualities.

He will cite another element too—of at least equal importance. For he will tell you that only through the skill, the scientific knowledge, the superlative mechanical equipment which the latter half of the twentieth century have made available, and the teamwork of many military and civilian agencies of both the United States and Canada, could so stupendous a project be accomplished at all. And in the same breath this man will voice his pride that varied units and individuals of the Bell System have joined in planning and executing this bulwark to our nation's defense and in bringing it to successful conclusion so that one day it may be turned over to others for operation. This is the DEW Line: the Distant Early Warning Line being set up across 3,000 bitter miles by sentry radar stations. And as we see the progress being made, let us look in the other direction, to the beginnings of the DEW Line project only four years ago—and to the ominous situation which called it into being.

The basic problem is summed up in two simple, disquieting facts: as today's jet bomber flies, any of this country's great industrial centers of the East and Midwest is but four to six hours from the shores of the Arctic Ocean; and the corollary, that if enemy attack comes from the direction of this polar area, we would have only limited warning before his bombers arrive on target.

Earlier warning was one answer to this

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Cargo for the DEW Line. A C-124 cargo plane being loaded at an advance base. Weighing 90 tons laden, it will land on winter ice near a radar site

threat, and in the summer of 1952 a group of scientists at Lincoln Laboratory of the Massachusetts Institute of Technology was devoting energetic consideration to possible means of changing minutes of warning time into from four to six hours: the flying time south from the Arctic. Could a radar system be built in the Arctic which would provide the means?

Only limited experience was available on which to base the design of buildings and of radar and radio communication equipment which would function under the severe weather and electrical conditions of the Arctic. But new techniques were under development which offered promise. So it was that the Summer of 1952 saw Lincoln Laboratory working closely with Bell Telephone Laboratories in developing and modifying communications equipment and building prototypes of new kinds of radar and communication facilities.

It was in December, 1952, that "Project 572" (code name for the DEW Line project) was born. Earlier that year, scientists at M.I.T. had made their proposal to the U. S. Department of Defense that an *early warning* radar line be built across the North American Arctic. The Department of Defense decided that a trial installation should be made, consisting of one segment of a distant early warning line. If this were successful, the rest of the line would follow.

Bell System officials were then asked by

The old and the new. An Eskimo in Hudson's Bay watches from his kayak as a freighter is loaded with supplies and materials for the DEW Line

the U. S. Air Force to take over the experimental project: specifically, to undertake the full responsibility for engineering, construction, installation, and operation of a chain of radar and communications stations on Alaska's northern coast—and have them functioning within a year. On top of that, the project included "preliminary surveys of a route across the Arctic, assess the logistic and construction problems involved in creating the complete line, and develop techniques for their solution."

The Bell System accepted the proposal and Western Electric was assigned the job.

This was one of the most unusual, difficult, and challenging assignments Western Electric and the Bell System had ever undertaken. It meant installing and testing new electronic and communication techniques under actual Arctic conditions. It also meant that everything needed to support a group of men living and working in the Arctic, plus a staggering array of heavy construction machinery and, of course, the electronic equipment itself, would have to be planned for, purchased, assembled at shipping points, transported to utterly barren and uninhabited locations in the Arctic, and there assembled and put into operation.

Why the Bell System?

It was because of the very complexity and size of the undertaking, because of the

On the DEW Line, tractor-drawn sledges transport everything from supplies to the assembled module units themselves

"On location": Some of the mountains of materials needed for the construction of the DEW Line

Excavations for tower foundations in the frozen tundra require blasting and the use of compressed-air-driven "jack hammers"

special problems involved in development, logistics, and construction, that the Bell System was chosen to handle this project in the first place. The Research and Development Command of the Air Force stated it this way in asking the System to accept the responsibility: "The Bell System with its integrated development, manufacture, supply and operating units appears to be uniquely qualified to assure the success of a project which is of the highest urgency and importance to the defense of the Country."

In other words, it was because of the Bell System's enormous reservoir of skills and experience; because of the very factors which make the Bell System itself a successful, smooth-functioning, integrated operation, that we were considered best suited for a job of this kind.

To get the job done, Western Electric immediately drew upon the Bell System's most valuable resource—trained manpower—to organize a special group to coördinate and manage the project. This team was assembled from all over the System: from Western Electric itself, of course, from 17 operating companies, from Bell Laboratories, from the Long Lines Department of A.T.&.T., and from the Northern Electric Company.

Not only were these people carefully selected for their skills and knowledge, but they also had to meet rigid physical and personality requirements and receive lessons in Arctic survival to be sure they would be able to withstand the rigors of life in the far north.

Some of them were soon living in northern Alaska on the shores of the Arctic Ocean. "Home" to them was a tent or a Jamesway hut, often in a place desolate, wind-swept, and profoundly cold. Encounters with polar bears and wolves, with vicious Arctic winds, with "ice fog" and "whiteouts," and with water scarcity when the lakes froze solid, became part of the everyday life of men who but a few weeks or months before had been engaged in quite different jobs in peaceful stateside towns.

Still other men were literally commuting between the Arctic and the U. S., shuttling back and forth by any and every means of transportation at hand. Materials had to be purchased and assembled from hundreds of suppliers and sub-contractors; plans had to be made to fly preliminary materials over the rugged Brooks Mountain range into the sites on the shores of the Arctic Ocean, or transport them by caterpillar train over ice and frozen tundra; preparations had to be made for the vast convoy of U. S. Navy ships which would carry the bulk of the supplies and equipment some thousands of sea miles from west coast ports to the sites when summer came.

Arctic Beachhead

IN THE DEW LINE JOB, as in a military venture, painstaking advance planning was essential. An item overlooked, something which didn't get to the right place at the right time, could make the difference between success and intolerable delay. Timing, too, was all important in both types of operation. The "offensive" had to be launched on a carefully planned schedule. In the case of the DEW Line, the "enemy" was ice. Departures of ships had to be timed for arrival in the north during those few ice free weeks or the whole year's effort could be lost.

The logistical problem of getting materials to the northside was formidable enough. On top of this was a two-part construction job. One was the building

"Main Street" at a DEW Line construction camp, with typical buildings and "traffic"

of a typical DEW Line installation in the United States where personnel could be trained, and new communications and detection techniques and equipment pretested before being installed in the Arctic; the other was, of course, construction of sites in the Arctic itself.

Aside from the cold and the distance from sources of supply, the Arctic imposes certain peculiar obstacles of its own in the way of any building program. One, and not the least of these, is the condition known as "permafrost." In the Arctic, the top two or three feet of the ground thaws in summer and supports a luxuriant growth of small plants and flowers. Below the thawed layer, for hundreds of feet, the ground stays eternally frozen. However, if a building is placed on top of this permafrost, particularly a heated building, it will soon melt its way into the ground. Therefore, buildings and even roads and airstrips must be constructed on thick "pads" of gravel which serve as insulation and keep whatever is built on them from sinking. Besides this, because of the permafrost, it is impossible to dig holes in the conventional manner. Only by the arduous and messy procedure of steam-pointing—melting a hole with a jet of live steam—or earth augers can pilings be set into the ground.

In spite of all such problems, many of which couldn't be foreseen because no such project had ever been undertaken before, work sped ahead on schedule. By the time the snows came and the Arctic Ocean was once more locked in ice, clusters of low buildings could be seen in the wavering light cast by the Northern Lights. Above them were strange rubber domes, like the tops of silos or astronomical observatories, housing the radar antennas which would sweep the cold northern skies.

As the darkness of the long winter descended, the deadline for the experimental line had been met.

And now the Big Job

ON THE MORNING OF February 22, 1955, the Air Force announced selection of Western Electric to build the radar warning system across the Canadian Arctic.

To the general public, this news story was the first positive indication that there was to be a DEW Line. To those behind the scenes, it did have special significance because of what they could read between the lines. This story proclaimed that the experimental line had been successful—hence, the decision to proceed with a complete DEW Line "across the top of the continent. . . ." Implicit in this story, too, was the fact that Western Electric and the Bell System as a whole were now launched upon an undertaking that was simply staggering in its size and complexity.

It was in the late months of 1954 that the Department of Defense had notified Western Electric that an agreement had been reached between the U. S. and Canada to extend the DEW Line. W. E. was again asked to be prime contractor—and again it had accepted. This meant assuming responsibility for virtually every operation, including engineering, procurement, transportation, construction, installation and testing of equipment and, finally, training of personnel.

Within three months, the project was well under way. Scores more people with special skills and training were being re-

Antenna for local radio transmission rises at the left. It is used for inter-site communication during construction

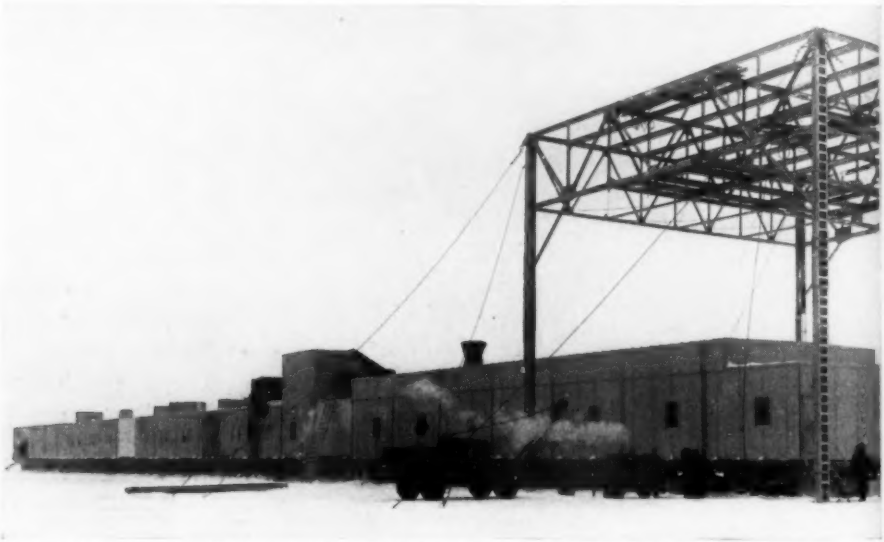
cruited from the entire Bell System. Arrangements were being made with hundreds of suppliers and subcontractors. Because of its size and the vast area it would cover, the project had been divided into three sectors. The actual construction work on each of these was assigned to a subcontractor.

The Alaskan sector was in the hands of the Puget Sound Bridge and Dredging Company of Seattle in a joint venture with Johnson, Drake and Piper, a combination of experienced construction firms that had already played an important part in the experimental line. The next or western Canada sector was in the hands of the Northern Construction Company and James W. Stewart, Ltd., of Vancouver, B.C. The Foundation Company of Canada had the eastern sector.

Selecting the Route

ALSO UNDER WAY in the early months of 1955 was a tremendous engineering task —selecting the actual route along which the DEW Line sites would lie and selecting and laying out the sites themselves. It was important to get the line as far north as possible—the closer to the Pole the more warning in case of an attack. But transportation, construction, annual resupply problems, and many technical factors also entered into the decision. The very geography, ranging from the flat tundra on the Alaskan end of the line to incredibly rugged mountains of Baffin Island in the east, presented problems too.

Before the final selection of a route was made, every available map of the American Arctic was studied, thousands of aerial photographs were taken and carefully examined, reports of previous Arctic exploration parties were studied. Every possible route was scouted by plane. Then, when the one route which held most promise from every point of view had been chosen, the next step began—the



A "module train" which will house DEW Line men and equipment is shown under construction. At right is structure to support radar antenna and radome

selection of the actual locations for the individual sites.

There was only one way this could be done. Someone had to go to the actual spots under study and make on-the-ground tests and surveys. This lonely and often hazardous assignment was undertaken by "field parties" of engineers from Western Electric and other Bell companies.

Selecting the Sites

EARLY IN THE PROJECT, while the winter cold and darkness still lay over the Arctic, these site selectors began their missions. Traveling sometimes by caterpillar train over the ice or frozen tundra, more often by light ski-equipped planes flown by skilled "bush" pilots, they went out onto terrain that only a few migrant Eskimos had ever visited before.

After hazardous landings, they would stake down their tents against the savage Arctic winds and go about making necessary electrical tests, surveying for landing strips and building locations, and searching for the gravel—or for rock that could be crushed into gravel—which in this land of permafrost is a necessity of life.

Since most of this siting work was done in the winter and early spring, the locations had to be chosen while snow was on the ground and visibility poor. Yet the men who went out and did the job not only did their work on schedule but, when the snow melted and the ground could be more thoroughly examined, only a very few locations had to be changed.

As sites were selected, airstrips were cleared on the ice so that heavier planes could land with construction people, equipment, and supplies. The first strips had to be cleared by hand or with small tractors which were parachuted in from U. S. Air Force C-119 "Flying Box Cars." It was a brutal, tiresome job clearing a strip long enough for even a light cargo

In the foreground is one end of a module train, the principal structure at a DEW Line site. In the background is the site's construction camp

Installing a kitchen in a module at a DEW Line radar site

plane. Sometimes two or three weeks' work was required before a strip would be ready for the planes. These in turn would bring the powerful mechanical equipment which was a match for the snow driven by Arctic winds and could start the necessary gravel haul and road and air-strip work.

Logistics in the Arctic

MEANWHILE, as the sites were being prepared, the huge construction job itself was coming into focus. A lot of material —and work—is required to build just one DEW Line site. There must be main buildings to house equipment and power plants, and the men who will operate them. Also required is a garage for motor vehicles and tractors, towers for antennas, fuel storage systems, roadways, permanent gravel airstrips, and sometimes hangars for planes.

The construction job itself required all sorts of heavy equipment: giant twenty-ton tractors, bulldozers, cranes, plus such specialized Arctic equipment as snowmobiles, "Herman Nelson" heaters, and steam-pointers for melting holes in frozen ground.

Of course, all the bulky materials and heavy equipment had to be brought in to the sites over tremendous distances complicated by Arctic weather. Most construction had to be done during the "warm" months from May to September. Yet ships couldn't get through the ice until late August or early September – almost the end of the construction season.

The problem which confronted the men charged with responsibility for the DEW Line was this: How can we get masses of heavy machinery and supplies into the sites before the construction season starts? Some means of doing this had to be found. Waiting until early fall for the ships would have meant loss of almost the whole year's work. The DEW Line was far too urgent a project for that!

At the West or Alaskan end of the line, the winter supply problem wasn't too difficult. Experience during the trial period in that area had proved it quite possible to bring material by air to an established airstrip at Point Barrow and haul it by cat-train, sometimes for hundreds of miles, over the ice and tundra to the sites. This could be done again.

On the Canadian part of the line, the situation was more complicated. Much of the country there was too rugged for cat-trains. The only answer was an airlift direct to the sites. It would have to be an operation of gigantic proportions involving the greatest armada of planes the Arctic had even seen.

The over-all logistical plan which was finally evolved called for the movement to the sites of some 30,000 tons of heavy machinery, building materials, fuel oil, and other supplies by air during the winter and spring of 1955. This was to be followed in the late summer with another 200,000 tons brought by U. S. Navy convoys from Seattle, Washington, and Halifax, Nova Scotia; and by barge shipments down the Mackenzie River, which flows northward into the Arctic Ocean.

Supplies by Air

THE WINTER AIRLIFT involved the use of hundreds of aircraft of practically all types, including giant U. S. Air Force

Some of the heavy equipment, much of it transported to the sites by plane, which is used in DEW Line construction. The covered bridge in the background enables men to go from their living quarters to the equipment area in even the severest Arctic weather

C-124 Globemasters which, when loaded, weighed 90 tons apiece. These were needed to bring in the heavier items of construction equipment such as the 20-ton tractors. Yet planes that size had never been landed on ice before. How thick would the ice have to be? That was just one of many questions which had to be answered by ice teams from the Air Force Tactical Air Command.

The airlift required thousands of flights by Air Force planes of the United States and Canada, as well as commercial aircraft. Many of these flights were made under "impossible" conditions of profound cold, wind, fog, and snow. Every available cargo plane of every type and size was called upon for the job. Some of them, coming all the way from the tropics, weren't winterized for Arctic flying, thus complicating the maintenance problem. There simply weren't any maintenance facilities along the Line and only the sketchiest of facilities where the planes were based. All repairs and servicing had to be done outdoors in the cold. In one case, when an engine change had to be made on the Line in sub-zero weather, the Eskimos built an igloo around the plane.

The entire airlift was a constant race against time and the weather, a venture involving long, exhausting hours of flying; work around the clock for ground crews. There was tragedy, too. Six pilots and co-pilots of commercial planes were killed and many planes were damaged. Yet by the time the spring thaws came, great stacks of materials stood among the drifts all along the Line. The building of the DEW Line was starting. The airlift had been a success.

Supplies by Sea

EARLY IN JULY two great fleets of Military Sea Transport Service ships – one from Seattle and one from Halifax – headed out and swung their bows northward, toward the mists and ice floes of the northern seas. The sealift had begun.

Each fleet had a complement of about 60 U. S. Navy ships–ice breakers, tugs, repair vessels, victory ships, LST's and many other craft large and small including ice breakers from the Canadian Navy. It was an impressive sight as the deep-laden gray hulls headed toward the horizon; a sight reminiscent of World War II days. It was a gratifying sight to the men of "Project 572" who for many months had been supervising the assembly of the thousands of tons of materials in those holds, who saw the ships loaded in June, whose single purpose for so long had been to get those ships on their way in time to make the most of the few ice-free weeks in late Summer.

To the Navy and Army Transportation Corps men aboard those ships, it was a dangerous and difficult mission. The routes they followed in Arctic waters were largely uncharted. They were almost continuously buffeted and harassed by ice, fog, and vicious storms. On the western end of the line, ice fields which normally blow offshore in summer, leaving the coast comparatively open, were brought down upon the heavy-laden ships by perverse onshore winds and threatened to crush their hulls against the shore. In other places, Navy demolition experts in rubber "skin diver" suits plunged into the icy water and placed explosive charges on hidden rocks and reefs which had to be removed before cargoes could be landed.

The Arctic Ocean took its toll. A number of ships were damaged. Three of them had to be towed out; two had lost rudders and propellers; one was stove in by ice and its engine room flooded.

Eskimos at a DEW Line supply base. The cheerful natives are hard workers and adept at many different tasks

Nevertheless "operation sea-lift" was a magnificent performance on the part of the Navy and Army. Not only was all cargo delivered on schedule, but in spite of navigational hazards, almost all of it was delivered to the spots where it was needed. In cases where certain sites simply couldn't be reached from the sea, their share of the materials was left at nearby locations from which they could be hauled in by air or by cat-trains.

Over 200,000 tons of cargo was landed on those northern beaches—an unloading job which required the combined efforts of several thousand U. S. Army troops. Altogether, it represented an incredible mountain of machinery, building materials, food, fuel oil.

And once again as the Arctic winter settled down, everyone on Project 572 could take pride in the fact that the deadlines imposed by the weather and the urgency of the project had been met.

The DEW Line Today

TODAY, AS IN THE PAST, there is much about the DEW Line which can't be talked about. Details of how and where construction is progressing, dates when it is to be completed and in full operation, are matters which for reasons of national security must remain shrouded in secrecy, along with information on how the equipment works, what it looks like, what it can do.

This, however, can be said. In spite of

Caterpillar cowboy

the newness of the DEW Line concept, in spite of all the difficulties imposed by climate and distance – and the hazards which have cost a number of human lives –the project is going well, and there is every reason to believe it will be finished on time.

Completed, the DEW Line will comprise a row of sentinels which will ceaselessly search the Arctic sky, casting forth into the darkness an invisible but effective electronic fence for the detection of hostile aircraft. If enemy planes should ever come, within split seconds that fact will be known in faraway U. S. and Canadian defense centers. Within minutes, the steps necessary to repel the attack and to safeguard civilian population will be under way.

And the DEW Line does not stand alone. It is tied into an interlocking communications network with the Mid-Canada and Pine Tree radar warning lines further to the south. It is a vital segment of the outer perimeter of a vast detection system which includes radar stations along both coasts (shortly, offshore "Texas tower" radar sites will be part of it too), radar picket ships and planes and the Ground Observer Corps, all with a common objective: To give us that most precious of commodities in these days of supersonic aircraft and nuclear weapons –*time*.

All through the winter months the airlift has continued. Not the same vast armada of planes involved in the first airlift, but a constant shuttling back and forth of building materials, food, fuel, men, and mail. And when the brief sum-

mer comes once more, there will again be other ships threading their way through the ice floes.

The new sites, as they near completion along that faraway coast, look, and are, quite different from the first ones built during the experimental days on the Alaskan coast.

In those early days the DEW Line men not only proved that they could build a DEW Line but they learned a lot too—about the equipment and about the Arctic. They found that despite modern machinery and ships and airplanes, man is not yet master in this tough, cruel land of extremes. He must adjust his ways to those of the land, yield to the harsh disciplines the Arctic imposes, if he is to live there in comparative comfort and safety.

One way they have adjusted to the Arctic is by developing a special "modular" type of building which reduces construction work in the north to a minimum, makes the most of every available inch of space, conserves heat, simplifies transportation problems, and has many other advantages for Arctic living.

The basic unit of this type of structure is the "module," a building 16 by 28 feet by 10 feet high. The modules are outwardly identical except for various door and window arrangements. Inside, each building is equipped for its special assignment. Some are filled with electronic equipment. Others house generators, sleeping quarters, kitchens, laundries, everything needed for a group of men living under Arctic conditions, and for their job of maintaining and operating the radars.

Doubly Pioneers

UP THERE NOW, doing the DEW Line job, are men from all over the world. Working side by side are Eskimos, South Africans, Australians. There are men from Canada, from Europe, Asia and from almost every state in the U. S. They are carpenters, "cat skinners" (tractor and bulldozer operators), electricians, plumbers, radio and radar technicians, riggers, airplane pilots, soldiers, sailors, scientists, engineers.

Some of these men of many trades and professions, of varied backgrounds, are employed by W. E.'s subcontracting firms, others are in military service, while still others, of course, are Western Electric people, many of the latter transferred in to Western from Bell telephone companies. Yet up on the DEW Line they are all one, a single, closely integrated team, welded together by the sense of the urgency of the job—a feeling that runs strong everywhere on the DEW Line—an *esprit de corps* born of the knowledge there is important, difficult, dangerous work to be done and that they are the ones who can do it.

There is something else, too, these men have in common. Though they have come by ship and plane and cat-train instead of the sailing ships and covered wagons of another day, they are as surely pioneers as others of the same sturdy breed who have gone into the forests, across the plains, on to new worlds turning a fresh page of history as they went. Indeed, the DEW Line men are doubly pioneers; they have opened new vistas in electronics as well as in geography.

A farewell message

THE LONG YEARS—THE LONG, FRUITFUL YEARS

HAL S. DUMAS

Executive Vice President, AMERICAN TELEPHONE AND TELEGRAPH COMPANY

WHEN I WAS ASKED to write down for the BELL TELEPHONE MAGAZINE, on the eve of my retirement after forty-five years of service, my view of the Bell System, I found this an extraordinarily difficult task. For it crowds together the expression of many experiences of a long and varied life.

One of the first questions I asked myself was whether, knowing what I know now, I would choose to start out again in the telephone business. My immediate answer to that question was "Sure," and then I tried to find out why I felt that way so completely and positively. As I dug deep into my own mind, these were the answers.

I have been associated with a business which renders to the people of this country one of the most essential services which I can think of. It gives this country the best and most widely used communication service in the world. It has conducted its business in such a progressive and effective way that the service this country receives is not only the best in the world but it is the lowest in cost of any in the world — when cost is measured in terms of the number of hours a man must work to pay his telephone bill.

Equally important to me is the integrity of the Bell System. I have worked in almost every level and every activity of the Bell System, and I have never had anyone suggest to me an action unworthy of the highest possible standards. On the contrary, I have found among all telephone people an active and anxious desire to avoid at all costs any action that might in any way damage the high reputation which is the System's greatest asset — just as it is the personal asset of every one of us who is associated with the System.

Right along with my pride in the System's accomplishments and its character go my affection and regard for the people who make it up. Perhaps I am prejudiced, but it seems to me that the people who make up the Bell System are the friendliest, the most devoted, the most kind and generous people in the world. When an emergency arises, they respond with every ounce of intelligence and strength they possess. When a charitable cause is presented to them, they respond with their money and effort as no other people do. If I could do it all over again, I would choose my friends and close associates among telephone people.

As have all of my generation, I have

lived in the most important and the most exciting era the world has ever known. During my years, we have fought the two greatest wars of all history. The world has become a great neighborhood. Freedom has spread its light through all except the Iron Curtain countries – and there are signs it may be penetrating even that pall of darkness. The average citizen in our country today has conveniences and possessions that were beyond the reach of kings when this era began.

My contemporaries and I are fortunate that during that same time, the telephone business has fully reflected the tumultuous era in which we have lived. I cannot remember that we have ever experienced a dull moment. As the country woman down in Mississippi said, "There's nothing daily about our lives." We have had to move rapidly to meet the wars, the depression, tremendous growth, inflation. All of the kaleidoscopic changes our world and our country have been so subject to during our lives have in my opinion demanded more from telephone people than from any other group. And wonderfully well they have met that demand.

YOU MAY HAVE GATHERED from all this that I am very proud of the Bell System. And you may wonder whether there are things I would change. The answer to that is that we have always been changing and I hope we shall always contine to change.

And what would I change now?

Well, first, I am concerned because we Bell System people are so efficient and so pleasant to live with, we are inclined to get ingrown. We may sometimes neglect the views and the excellences of people outside our business. Because we are the best in the world is no assurance we will always remain that way unless our minds are alert and open to all the ideas generated by anyone anywhere in the world. Our knowledge of the sound reasons for our own actions is of little use unless we explain those reasons to the public at large. Our certainty of the integrity of our motives is of very little value unless those whom we serve are convinced of our honorable intentions. It seems to me that smugness is a cardinal sin, one into which we may easily fall unless we continually remind ourselves that we may have a tendency in that direction.

The other thing that troubles me about our System is the difficulty, as in any large organization, of maintaining the importance of the individual. God made man only a little less than the angels, and He did not mean for him to become a cog in the machinery. As a matter of fact, there are absolutely no unimportant people in this System. Each of us has an essential part in the greatest industrial democracy the mind of man has ever put together. Some of our jobs sometimes do get rather "daily," and it is then that we need to sort of step away from the routine and take a renewed look at this wonderful thing in which all of us are engaged. We must each of us find ways of recreating and sustaining that joy of accomplishment that is the right of every man and woman.

Perhaps what I am trying to say is that none of us can afford to let the complexity of our civilization eat away the dignity and the importance of any human being anywhere.

As I LOOK BACK over my forty-five years, my sole regret is that I could not have done more for the Bell System and its people, that have done so much for me. May God bless and prosper every one of them.

THE CABLE SHIP HMTS MONARCH began laying the second cable in the transatlantic telephone cable system on June 13. After making a splice to a shore-end section of cable, the MONARCH left Oban, Scotland, and proceeded to Rockall Banks, a point some 500 miles from shore. Here she was to buoy the first segment of what will be a three-segment laying operation to be completed by late August. Last summer, laying cable from Clarenville, Newfoundland, to Oban, the vessel put down the first cable in the system.

Also on June 13, a start was made in laying the first undersea telephone cable between the United States and Alaska. The 7,800-ton cable ship ALBERT J. MYER will lay about 530 miles of deep-sea cable, or enough to cover about two-thirds of the route between Port Angeles, Wash., and Ketchikan, Alaska. She will then return to Seattle to pick up enough cable to finish the run. Starting at Ketchikan, a second cable needed to provide two-way telephone channels will then be laid. At Ketchikan the underseas cables will be linked with the facilities of the Alaska Communication System, a branch of the U. S. Army Signal Corps which furnishes long distance communication throughout Alaska. Construction of the new cable system is being undertaken by the Long Lines Department of the A. T. and T. Company, while The Pacific Telephone and Telegraph Company will build the short radio relay route between Port Angeles and Seattle. The $15,000,000 project is expected to be ready for service late this year. It is much like the transatlantic system and has a total of 39 built-in repeaters every forty miles along the route.

Do our size, increasing mechanization, fewer customer contacts, make us appear impersonal to customers, remote from the daily life of communities we serve?

SERVING THE COMMUNITY—FROM ITS POINT OF VIEW

SANFORD B. COUSINS

Vice President, PUBLIC RELATIONS DEPARTMENT, A. T. & T. CO.

WITHIN THE MEMORY of the youngest of telephone people, many changes have been taking place in this nation of ours. In the span of a generation, our population has increased over 50 per cent. Our cities have spread out into the countryside. Every day we are growing bigger, but even as we grow we are being pulled closer together by the automobile, airplane, television, and of course the telephone.

We Americans are sociable. When we do business, we want the occasion to be pleasant. We like informality. In the canyons of Manhattan just as on Main Street, housewife and grocer discuss the weather as well as the price of tomatoes and beans. In Chicago just as in Chatham Corners, the local merchant likes to know his regular customers by name. The growth of our country has not altered the fact that each of us lives in a community and is part of that community. We are neighbors as well as bankers, tradesmen, or telephone company employees.

There's a meaningful story told about two supermarkets that opened recently in a new subdivision.

One of the markets was a perfectly-designed machine for shopping. It was spotlessly neat, with white tile walls, uniformed clerks, a regulated traffic flow. Its weekly income was $28,000. The other market was less orderly, more like a home where a large family lived. Youngsters lounged by the magazine rack and read comic books while their mothers shopped. There was a play pen run by a woman everybody called Elsie. This store did a business of $50,000 a week.

The first store offered lower prices, a bigger selection, more brand names. The owners couldn't understand why people preferred the other market. Finally, they called in consultants and asked, "What is it we're doing that is wrong?"

To say there is such a thing as "too much efficiency" is over-simplifying. Efficiency is a desirable and constant goal in our own business, but long ago we found it must be accompanied by human warmth, by responsiveness to the needs and wants of individual and community.

As America grows and changes, how successfully are we meeting people's needs

"The best way of communicating with the community is to communicate with employees."

and wants? Are we living up to the community's expectations? What are we doing that is wrong from the community's point of view? What can we do better?

What does the community think of us?

APPRAISING WHAT THE COMMUNITY thinks of the telephone business is a fascinating, never-ending undertaking. We serve some 7,000 communities. All are different. We provide service to some 32 million individual customers, and many more use the telephone. Practically everybody has some sort of opinion of us: favorable, unfavorable, neutral.

Unlike the operators of a supermarket, we can't just glance across the street and see that a rival is attracting more, or fewer, customers than we are. To get a picture of the community's opinion of us, we must rely mostly on the attitude people display toward us in day-to-day contacts, surveys, and occasional studies. We must try to interpret what they tell us, try to figure out what we are doing that makes them feel the way they do.

We, ourselves, know that telephone service is generally excellent and getting better all the time. From our regular attitude trend studies, we know the public thinks so too. Their attitude toward our *service* has shown gradual improvement in the post-war years. In the same period, the way customers feel about the *cost* of our service has had its ups and downs; recently

the feeling has been more favorable. But, curiously, the way people feel about us as a *company,* as a corporate citizen of the community, has been about the same for the eight years we have carried on the trend studies. As statisticians say, the curve is "flat."

The flatness of this curve makes a question inevitable. Why hasn't attitude toward the company improved along with improved telephone service? Have we been doing something that keeps people from liking us better? Have we failed in some way to meet the community's expectations?

Last year a telephone company made some experimental interviews to find out *why* customers felt the way they did. Since human beings are complicated, it's not surprising that their feelings about the company were often a mixture of favorable and unfavorable.

Most customers thought of the company and of telephone people as "solid citizens." At the same time, some of these customers said we were "formal" or "drastically courteous" in our business contacts. Some said that while telephone service was "excellent," they didn't feel warm toward us. Some felt we were "impersonal" or followed rigid "rules" that didn't take the customer's own wishes or problems into account.

Some customers said the business was "well run" but that we were "demanding" in wanting people to use the telephone "properly." Others said we were "technically competent" but often seemed "remote."

Again, questions are irresistible. As our business has grown larger, have we unintentionally become impersonal in some of our contacts with customers? Do mechani-

An employee who is hostess at the central office to the members of her social club is "building a closer link with the community."

This traveling manager (right), preparing to give a talk in a CDO community where no telephone employee lives or works, helps to prevent situations out of which the customer can get the feeling that we are "big," "remote," or "impersonal."

zation and the lack of local employees make us seem remote from the life of the community? Has our difficult shortage of facilities sometimes made us seem heedless of customers' needs? As we try to interpret the feelings of the community, much of what customers tell us seems linked to these three familiar problems: – our size, mechanized operations, and shortages.

Are we too big?

WE HAVE OFTEN SAID we are big because we must serve a big country. To many thoughtful people, our size means strength to serve. It enables us to provide, for example:

- Efficient nation-wide service.
- Economies and technical advantages of large-scale manufacture of equipment.
- Intensive research to improve service.
- A research-manufacturing-operating team on which the government relies for important contributions to defense.
- Resources and ability to act swiftly in emergencies.

While people recognize these enormous advantages, they often tend to suspect the motives of large-scale enterprise. This has been a strong current in American thought since before the turn of the century. When we ask customers just how they feel about the size of our business, very few say "too big" but a large number say they have "no opinion." Naturally, we hope these "no opinion" people can become our friends, not critics.

In decentralizing our operations and in delegating greater responsibilities to local telephone management, we are setting the stage for closer relations between com-

pany and community. Now responsibility to serve the community can readily be delegated — but not the initiative to do the job. Initiative comes from within us. Often local management knows the right thing to do in the community but may doubt its own good motives.

For example: a small-town publisher died not long ago after a long and distinguished career. He had been greatly admired by his employees and the townspeople. The newspaper shut down to allow all employees to attend the funeral; all except the paper's two PBX operators could go.

The manager of the telephone company thought: "Why don't I send a couple of our operators to handle the PBX during the funeral?" Then he began to have doubts. Was he authorized? What if something happened? Would he or the company be liable?

Finally he called the publisher's son and offered two girls to relieve the paper's own PBX operators. His offer was gratefully accepted. It made a deep impression.

The problems mechanization imposes

OUR ABILITY to give constantly-improving telephone service is based on a long chain of scientific discoveries and technical developments. Without mechanization, the kind of service we have today would not have been possible.

Mechanization has been helpful to the human side of our business. By overcoming the limits on expanding our plant, mechanization has enabled us to keep enlarging our operations. It has created employment opportunities in our business, created new opportunities for share owners. It has led to higher wages, to many more skilled jobs.

Yet we know that for all its advantages, mechanization does create a number of special community problems. As we serve more customers, we have relatively fewer chances to meet them all personally. As service improves, we have fewer complaints, relatively fewer customers calling or coming to see us.

Ten years ago, employees' on-the-job contacts with customers averaged 1,003 per main telephone per year. By last year, this figure had declined to 499. If this drop continues, by 1965 the figure will be only 204.

Dial offices now serve some 3,500 communities where no telephone people work or live. The service provided by these community dial offices (CDO's) is generally excellent. Especially in localities where dial has replaced manual, customers say they like dial service much better. But we find that better service in itself does not make people like us better as a

"Knowing how people feel about our service and our company is immeasurably valuable to us." This young man is conducting a survey of customer opinion.

"Local management teams that meet regularly to evaluate the community's viewpoint and then make plans for improvement."

"A company-wide plan under which employees living—but not working—in CDO towns form committees to deal with community relations."

company. Without our intending it to be so, mechanization brings with it the risk of our seeming remote or impersonal.

The introduction of direct distance dialing means we must ask customers to learn new ways of dialing. The results are sometimes frustrating. For example, a trucking company recently reported it was getting about one hundred wrong numbers daily; the firm had the same telephone number as that of a large railroad terminal in an adjoining state. Local residents who were calling the railroad station were forgetting to dial the code that would route their calls interstate.

Familiarizing the public with new dialing procedures is largely an "educational" problem to be approached through instruction and advertising. Ideally, our educational efforts should show we want to help people get the most out of their service, with the greatest convenience; but there is always the risk that what we say, or how we say it, may leave the impression we are "demanding" in our relations with customers.

Our goal is to give every customer the service he wants when he wants it. In striving to meet this goal, the operating companies and Western Electric have set a splendid record of achievement. We have added over 23 million telephones since the war — more telephones than were then in service. Technical service is the best ever. We are engaged in a tremendous construction program. Still we have not always been able to give the customer what he wants.

There were good reasons, of course, why our efforts fell short. Whether or not we always made these reasons clear to customers had its lasting effect, favorable or unfavorable, on the community.

Four broad principles

OUR SIZE, mechanization, and shortages seem to be the three main obstacles we must surmount as we try to serve the community better. There are others, such as turnover and inexperience. Any of these problems may lead to situations out of which the customer can get the feeling we are "big," "remote," or "impersonal."

There is no simple way to attack this package of problems. They can't be corrected solely by our taking part in civic activities, even though this is very important. Interviews with customers, open houses, talks, and films are important too, but not the sole answer. It seems evident that good community living covers everything we do in the community: our service, our operations, our citizenship.

How shall we go about improving the over-all impression made by our service, operations, and citizenship? Perhaps we can correlate hundreds of possible approaches and activities into some broad principles. Here are four:

First: All of us need to assume the responsibility and take the initiative for building a closer link with the community.

Feeling responsible for the community link is largely a state of mind; exercising that responsibility then comes more readily. Achieving this state of mind needs the sympathetic support of both staff and line people. We must encourage belief and freedom for action among those who, by working in the community, know it best.

Second: We must know how we are doing from the community's point of view and be sensitive to that viewpoint.

Our standard indexes are guides to what we believe good service is. From surveys we get a broad idea of what customers think of us; from face-to-face contacts with

"Good community living covers everything we do in the community." The mayor breaks ground for a telephone building in the presence of civic and telephone officials.

customers, from interviews, contact memos, letters, and newspaper comments we get a more detailed picture of how we are doing. From employees we get first-hand accounts of what their friends and neighbors think of the company.

Some local offices are now feeling the pulse of community opinion through calling customers in CDO communities and asking how they like our service, and are considering adding other questions of a broader nature. One company has sent out two million postcards to customers asking for signed opinions and suggestions and has followed up with personal visits to those customers who are critical or dissatisfied.

Knowing how people feel about our service and our company is immensely valuable to us. Customers' feelings and opinions are the raw material we use in planning for more effective community living.

Third: Develop specific organizational plans locally.

Mr. Craig has said in the pages of this Magazine that thinking and acting in the community's behalf can't be imposed, can't be brought about by direction. Planning for better community living evolves from what local telephone people *know* the community needs and wants. The approach to good community living may be very different in different communities. Here are just a few examples of local organizational efforts:

- Local management teams that meet regularly to evaluate the community's viewpoint and then make plans for improvement.
- "Building teams" that work regularly on community living problems in very large urban centers.
- In small communities in one state, committees of both management and non-management employees that meet to consider community living problems.
- A company-wide plan under which employees living in CDO towns form committees to deal with community relations.
- An experiment in which a roving local

manager takes over responsibility for customer contacts in CDO towns.

Fourth: Communicate effectively with the community.

In many ways, we do a good job of explaining our service, our problems, and our intentions to the community. Central office visits, films, talks, and exhibits are important in keeping the public informed. More of us are taking part actively in community affairs, and we can be proud that telephone people want to be participants, not merely joiners.

Probably the surest way to tell our story is through keeping telephone employees well informed. They are the ones who represent the company in the community, whether they work and live in town or just live there. By what they say and do, their influence is tremendous. The best way of communicating with the community is to communicate with employees. Furthermore, as we listen to them, they can help us become more sensitive to community viewpoint. There are many examples to suggest that employee understanding of our objectives in community living and participation in them represent a large untapped potential.

We have sometimes seemed surprised when employees have taken on with spontaneous enthusiasm an activity that helps link company and community. I believe this enthusiasm is latent in nearly all our people. They like to take part, feel responsible, play a larger role.

It comes from within us

IN THE long range, community living can not be a "program" we impose on the community. It must grow out of our own genuine desire to work for the community's

Employee participation in community activities "must grow out of our own genuine desire to work for the community's interests."

Les Shields, whose sincere interest in his community won him an unusual token of recognition.

interests. I am sure that if this is our intention, the community will be warmly responsive to our efforts.

Not long ago, commercials on "The Telephone Hour" and on our TV program, "Telephone Time," told the story of Les Shields, a cable splicer with the Pacific Telephone and Telegraph Company, whose sincere interest in his community won him an unusual token of recognition. For 20 years Les Shields has been working in his home town to provide more and better playgrounds for the youngsters in the community. For 17 years Les has served on the school board, rarely missing a meeting.

Then last year there came a time when his colleagues on the school board hoped Les *would* miss a meeting. They had a surprise for him.

Finally, Les did miss a board meeting, and on that night the board voted to name the new elementary school after him — the Lester W. Shields School. This was how the board expressed the community's appreciation of the way a telephone man had devoted his spare time and energies to helping the community. And we in the Bell System are fortunate that there are many, many other men and women like Les Shields who serve their communities not only as telephone people but as good neighbors and good citizens.

Ours is a unique business. Our service, operations, and citizenship are part of the daily lives of millions of Americans. So it is natural that we dedicate ourselves to serving the interests of the community. This dedication is summed up in a concise statement in the last Annual Report:

"(Working for the community, from the community's point of view . . .) means something more than just doing what we may feel is the right and best thing to do. It means first of all being truly a part of the community. It means living in the community, taking part in community affairs, understanding what the community view really is. It means making every diligent and thoughtful effort to insure that community and company interest will find a common ground.

"Nor does success in these efforts come by direction from the top. It grows with the growth in understanding and ability of local men and women who *are* the telephone company in each village, city, and state.

"Recognizing this, the Bell Companies are broadening and extending opportunities for study and training by managers of local divisions and districts. The objective is to keep pushing responsibility and authority farther and farther out to those who are really in and of the local community. To repeat, it is they on whom the business must rely to discern local needs. It is they who know best how to meet them. Not only telephone service itself, but all our local conduct and citizenship, depend on the free exercise of good judgment and broad judgment by local people. Fortunately, we have this situation now, in great and increasing measure."

Both present and future loom large in any consideration of the Bell System's responsibilities to this nation and its millions of people

THE OPPORTUNITIES AT HAND —AND FAR AHEAD

EUGENE J. McNEELY

Executive Vice President, AMERICAN TELEPHONE AND TELEGRAPH COMPANY

(Based on a talk given on March 17, 1956, at the centennial exercises of the School of Engineering of the University of Missouri)

IT IS TRUE in most organizations of established continuity that past, present, and future flow on and on in a constant, growing, inseparable stream. That is certainly true of the company in which I serve. And yet to convey any sense of the way in which it functions as one of this nation's great public servants, it is necessary to establish a schedule—so to speak—of orderly discussion. Without trying to separate the eras too abruptly, then, let us approach our topic by way of the past; find some path which leads us to the age in which we live; and discover then how far and how logically those two will guide us into the years which lie ahead.

The telephone's past need not detain us long; for it was in 1876—only 80 years ago —that Alexander Graham Bell spoke the first sentence to be transmitted over a wire. Suffice it to say that in the ensuing eight decades the telephone, once regarded as a toy, has become the nerve system of a nation.

My own connection with the industry goes back for somewhat less than half that period: only 34 years, to be exact. Great things had been accomplished in communications by the time I joined the Bell System, but I can still recall the enthusiasm with which we looked ahead in those days, because we had two major developments on which to build: the electromagnetic relay and the vacuum tube. Today's telephone communication systems have been built around these two instrumentalities: the relay for the complicated job of interconnecting telephone lines, and the vacuum tube for extending transmission to great distances. Many other complicated devices have been based on these two major developments.

Today the Bell System, one of the world's largest private enterprises, joins with 4700 independent telephone companies in this country to give the best telephone service in the world. Together they interconnect more than 56 million telephones here at home, and can connect with some 40 million in the world outside. This country,

with six per cent of the world's population, has 57 per cent of the world's telephones.

Today's Counterparts

A FEW YEARS AGO, a new device known as the transistor was invented at Bell Laboratories. As Dr. Mervin J. Kelly, president of the Laboratories, said, "This device is one of those big break-throughs in science that occur only at rare intervals. Just as the vacuum tube and the relay symbolized the past era, the transistor will symbolize the era beginning to unfold."

Fortune magazine characterized it in these words: "The transistor and its minute relatives will amost certainly stimulate greater changes in commerce and industry than reaction motors, synthetic fibers, or even perhaps atomic energy. In the transistor and the new solid-state electronics, man may hope to find a brain to match atomic energy's muscle."

In the telephone business, the transistor is already a vital part in the complicated computer type switching systems that will ultimately enable any telephone user to dial his calls across the continent as easily as he now dials his calls across the street. In fact, people in many communities are already doing so.

Transistors are in various products now on the market and in secret war devices, and Dick Tracy's wrist-watch radio could now be a commercial reality if only there were enough available frequencies.

The Bell Solar Battery, which converts sunlight directly into electrical energy, is new, and is being used on one experimental project to provide telephone service. Also, so-called over-the-horizon radio service is being used on an experimental basis to provide telephone service between Florida and Cuba. This is a distinct departure from radio transmission as we have in the past known it.

Stages in the development of the electromagnetic relay

Our intercity telephone network resembles a huge spider web. Great progress has been made in its development, and it is now composed of microwave radio systems, coaxial cable systems, aerial and underground cables equipped with carrier —with a relatively small part of it on traditional open wire.

Each microwave channel can be equipped to carry up to 1,800 conversations simultaneously, as can also each pair of

Stages in the development of the vacuum tube

tubes in a coaxial cable. The microwave systems send their energy in a narrow beam; they do not "broadcast" their waves and thus use frequencies very efficiently. As I am sure all of you know, there is a great demand for radio frequencies—so much so that their scarcity is the limiting factor in the development of such services as mobile-radio telephone service and commercial plane-to-ground service.

The network of intercity circuits continues to grow. Last year, for example, we established another "backbone" route across the country, using both radio relay and coaxial cables. To make even surer that essential services will be maintained in time of disaster, and also to provide for continuing growth, we are working on construction of 5,500 miles of new "express" routes. These will by-pass congested areas that might be primary targets in event of war, and will connect with existing routes outside such areas.

Our network serving the television industry continued to grow in 1955. The network now reaches 390 stations in some 260 cities, and can carry color programs to about 270 stations in more than 150 cities. In addition to television broadcasting, there is considerable use of "closed-circuit" networks for sports events, sales meetings, and for other purposes. Last year, for example, there were more than 25 closed-circuit programs, each going to theaters, hotels, or other locations in cities across the country. For sales meetings, color shows merchandise to best advantage; and in 1955, we used closed-circuit color television ourselves to promote a nationwide telephone sales program—to good effect.

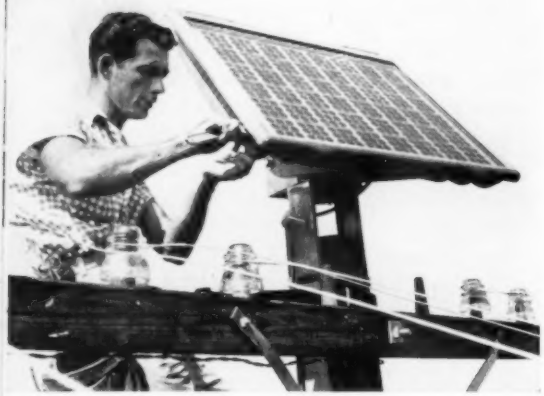
The Telephone's Part In National Defense

THOSE ARE BUT SOME of the particulars of our present communication developments. Before we look at what the future holds, we must pause to regard one great and inescapable problem which confronts us day and night.

Our Western civilization is threatened by an ideology that seems bent on destroying our way of life. If open warfare should come for which we were not prepared, our civilization could collapse or be set back hundreds of years. To help prevent such a cataclysm, our nation is building a defense system.

The telephone system is an essential part of this defense set-up. Recently the Director of Communications of the Air Force said, "As an assistance to national defense, particularly in the air defense aspects, the telephone system is becoming a greater national asset each year."

All branches of the Bell System are continuously at the service of the Army, the Navy, the Air Force, and other government departments. We do not make it our practice to seek military contracts, but when we are asked to perform work in the fields where we are specially qualified, we make special effort to meet the requests. There are three reasons why we are called on. In the first place, communications are literally the first line of defense. Second, modern weapon systems use in large measure the same art that we use in telephone systems. Third, the skills of communication experts cover the whole range of inventing, building and operating systems that use this art.



The Solar Battery, which derives its power directly from the sun, is an invention of the Bell Telephone Laboratories

In 1955, Bell Laboratories continued to work on electronic methods for the control of new defense weapons, and Western Electric, our manufacturing arm, maintained high-level production of guided missile systems to protect American cities. Also last year a 1,500-mile submarine cable system was completed for a guided-missile test range over tropical waters north of the Caribbean; this was largely engineered by Bell Laboratories and built by Western Electric. In the far north, construction proceeded on the Distant Early Warning Line* of radar stations, and also on related military communication facilities in Alaska. The Sandia Corporation, a Western Electric subsidiary, continued to manage the Atomic Energy Commission's Sandia Laboratory in New Mexico, which develops and designs atomic weapons.

The Air Force has asked us to provide certain services for its proposed semi-automatic air warning and control system known as SAGE. This is a system for tying together radars and defense weapons through a chain of electronic computing centers. It was developed by the Lincoln Laboratory of M.I.T., and is being built to provide the nation with a more nearly automatic defense against air attack. It is not a new air defense system, but an improvement over the existing system for which the telephone companies now provide communications. Western Electric has been called on to design and supervise construction of key government-owned buildings to house SAGE equipment, and to coördinate engineering and administrative work. The Bell telephone companies, and the non-Bell companies likewise, are to provide the interconnecting communica-

* See "The Dew Line: Sentinel of the Northland," in this issue.

tion facilities and services.

Among the chores that the SAGE system will perform are the following: First, transmit the knowledge of any possible aircraft target to centralized locations; second, compare each flight with innumerable known flights of friendly aircraft; third, sort out and spot any enemy flight; fourth, compute and advise which form of defense is best for the problem as it presents itself; and finally, if interceptors are involved, guide the pilot to his target and guide him home after the battle.

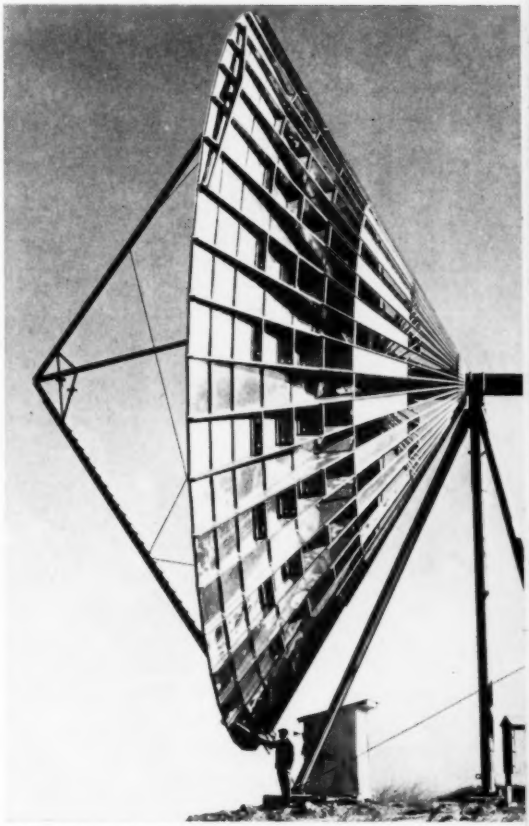
I mention all of this defense activity because I feel very strongly that our ability to defend ourselves against any style or form of aggression will depend a great deal upon the advancement of the communications art. Bell System efforts in this field are of course integrated with those of many other great organizations.

What the Future Holds

LET US TURN NOW to pleasanter topics: the future, and particularly the telephone's part in its development and enjoyment.

Just as 34 years ago we didn't even dream of television, radar, microwave systems, switching systems with built-in logic and memory, controlled atomic energy, and other such developments, it is safe to say that many things will be developed in the next half century that haven't been dreamed of today.

Communications in the new era will be favorably affected by a new philosophic concept known as "information theory". This is a complicated mathematical theory which tells us that all forms of information can be measured or expressed in a quantitative way. The unit of measure is the binary digit, which is contracted to "bit" (a "bit" is a yes or no answer—in electrical language a pulse or no pulse). Fortunately this language turns out to be the natural language of machines so that we can easily translate the written word or the sound of the voice into trains of pulses. These trains of pulses can be generated and processed, for example, by diodes and transistors which can conduct or not conduct and by capacitors which can be charged or uncharged.



Side view of an experimental 60-foot antenna for receiving telephone and television signals transmitted by an over-the-horizon technique

Telephone systems based on this understanding of information and implemented

Monitoring transmission for a closed circuit television program

with modern high-speed electronic devices, such as the transistor, will offer great advantages. For example, a new switching system capitalizing on the high speed of electronic switches and using fast electronic memory is under development.

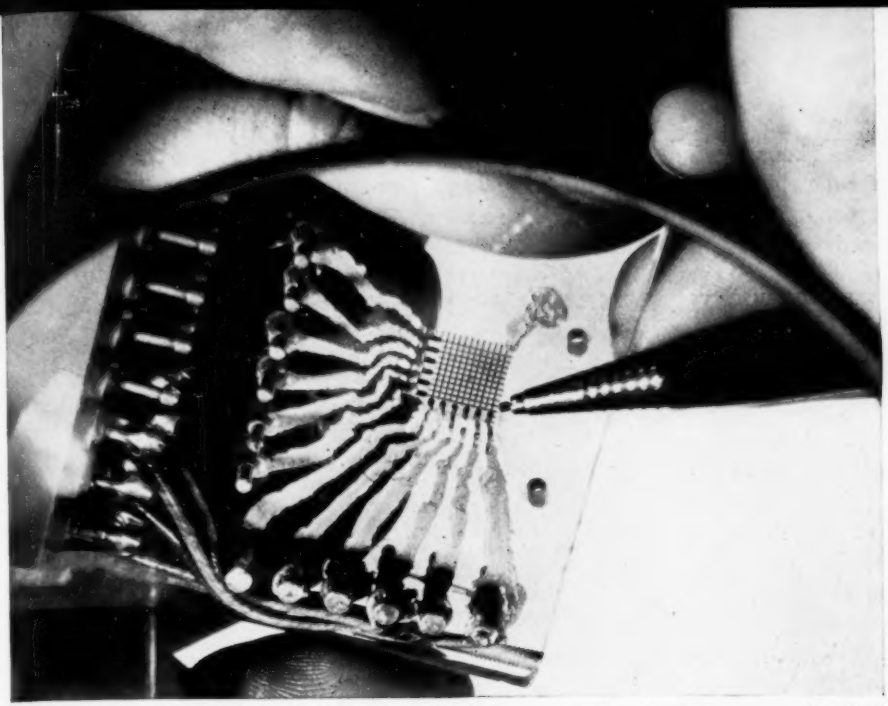
Within the next two years we expect to put into service the first electronic switching office. Whereas today, when you dial a number, a thousand or more relays must operate to put your call through, the new electronic system will have no moving parts. It will be much smaller than present systems, perhaps less than one-quarter size. Its fast electronic logic and memory will enable it to diagnose its own troubles and will make possible new kinds of services not feasible with present electro-mechanical systems.

There are other predictions that can be made without hesitation. The communications industry will grow; the current types of services will be improved in their usefulness; and new forms of communications service will become available.

This year the telephone cables to England will be completed, and telephone conversations to London and the Continent will be as good and as dependable as any other intercity conversations. By the end of this year a submarine cable to Alaska will be in service, and by the end of next year one will be completed to Hawaii.

At some time prior to the close of the century, there should be more than 100,000,000 telephones in service in this country. A great many of the telephone sets will be in color. An extension telephone in each room should be as commonplace as an electric outlet by each chair. Party lines should disappear. Hands-free telephones will be in general use and a second line to residences will be commonplace.

Much equipment will be miniaturized



Tiny crystals, only thousandths of an inch thick, a quarter of an inch square, and etched in minute cross-hatchings, have remarkable "memory" qualities which are important in new forms of communication

(which is of particular importance on the military side), and the power required will be small indeed compared with the present. The equipment elements will function in millionths of a second instead of thousandths of a second as at present. In a millionth of a second we now know not only how to switch something, but even how to perform more complex operations involving choices based on conditions at the instant.

Paging devices the size of a pack of cigarettes will be regularly used in the next few years. They can be carried in the pocket or purse, so that anyone can call you to the nearest telephone regardless of where you are.

Higher speed teletype transmission will be placed in commercial service to supplement the present 60-word machines.

Data transmission over regular telephone circuits will be used generally, permitting efficient centralized bookkeeping by national concerns.

The use of facsimile over telephone circuits will be extended.

Television and other forms of visual communications will be used in industry.

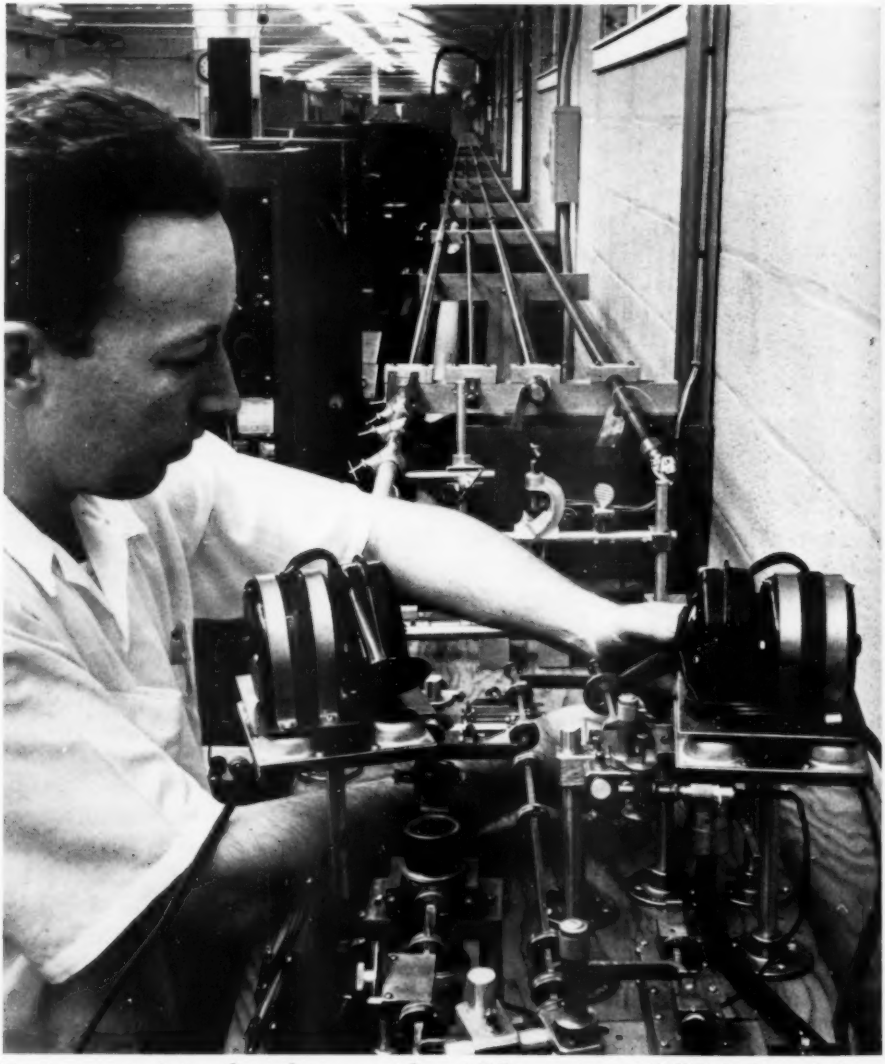
Extensive research is being carried out on an entirely new system of mass production of intercity circuits. It seems reasonably safe to predict a hollow tube waveguide transmission system between cities or communities, in which two hollow pipes associated with appropriate electronic circuitry will handle tens of thousands of voice circuits and hundreds of TV pictures.

These are only a few of the things that one can readily foresee in the civilian picture.

I know you can visualize the potentialities of the principles used in guided mis-

siles. I know that you can see the necessity for the rapid completion of the DEW line around our northern outposts, the intermediate warning lines, and the SAGE System—and why so little can be said about them.

Those of us in communications now and those who may join us will carry a heavy



Testing transmission through wave guides of different sizes at Bell Telephone Laboratories. A two-inch diameter was found to be best for the flexible hollow tube, a new and radically different way of transmitting telephone conversations and television programs over long distances

responsibility, now and in the years ahead, both for the defense of our country and for the maintenance of good communications which are so necessary to our way of life.

So far I have emphasized things and more things—and a few ideas. Yet I have left until now the most important element in any organization: People. The success of any organization, business, city, or nation depends upon three things: (1) the kind of people in it—their character, their ability, their objectives; (2) the money, material, information, equipment available; and (3) how well the people work together as a team.

With all of the brilliant research that has been done and all of the amazing scientific discoveries, we still know very little about people and why they act as they do. Jealousy, greed, a desire to be a big shot or to dominate others is just as common now as it was 100 years ago. We hope progress will be made in this field in the years ahead.

Understanding our fellow human beings is a difficult problem, and knowing what to do about it is even more difficult.

We all have to work at the human side of the job just as hard as we work at the technical side, because only through that effort can we find real success and happiness.

While our telephonic communications industry as a whole is big, it is essentially a community operation, and it can only survive as now constituted if it works for the good of the community *from the community's point of view.*

Such is the scope of telephone communications today—in the aggregate large to serve a nation, yet dedicated to the best interest of each local community. As it inevitably grows bigger, so must it grow more closely integrated with each of the places it serves and the people who use our services.

Two additions have been made recently to the group of passenger vessels furnished with ship-to-shore telephone service with the United States, thus bringing the total to 36 liners. The Empress of Britain, of the Canadian Pacific Steamship Lines, which began its maiden voyage between Liverpool and Montreal on April 20, and the M. S. Bergensfjord, new flagship of the Norwegian American Line, which reached New York on June 8, are the latest ships on the high seas to offer such service to their passengers.

Communications, Participation, Interest, Human Relations – all these factors make important contributions to better accident prevention both on and off the job

IMPROVED SAFETY THROUGH EFFECTIVE COMMUNICATIONS

WILLIAM H. GOODMAN

Plant Organization and Training Engineer, DEPARTMENT OF OPERATION AND ENGINEERING, A. T. & T. CO.*

IN AN ORGANIZATION where the safety performance as a whole may be good, it is not uncommon to find a group within it which is having difficulties. An occasional comment is that "We are continuing to have accidents, and yet we are doing everything we can think of to prevent them. For some reason, our programs are not producing the results we would like."

In such cases, it may be well to consider whether the lines of communication are functioning properly.

The question of improving safety through effective communications raises the question, "Are we reaching our people?" This subject is related, either directly or indirectly, to the problem of reaching all of our people with our everyday programs, thoughts, ideas, and other messages we would like to have them receive. For regardless of how good our programs and intentions may be – their effectiveness will depend on how well they reach our people.

The significance of effective communications is better understood when it is realized that it is common to all phases of our business: sales and merchandising, public relations, courteous and satisfactory service, and safe and efficient operations – to name but a few. The question of "Are we reaching our people," is a broadly significant one. In the field of safety, or accident prevention, consideration of the problem raises two points: is there something we should do; and if so, what and how?

When one views the problem broadly, it seems apparent that there is need to explore in this field. In other words, as long as we have a "zero objective," but still have accidents, we must direct additional effort to reaching our people. This may be done without detracting in the least from the fine job that has been done so far. A lot of progress has been made in the accident prevention field, and this progress is the result of continuous effort of all employees, both management and craft. We can all be proud of the progress that our charts reveal.

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*Since June 16, 1956, Assistant Vice President, Merchandising, Northwestern Bell Telephone Co.

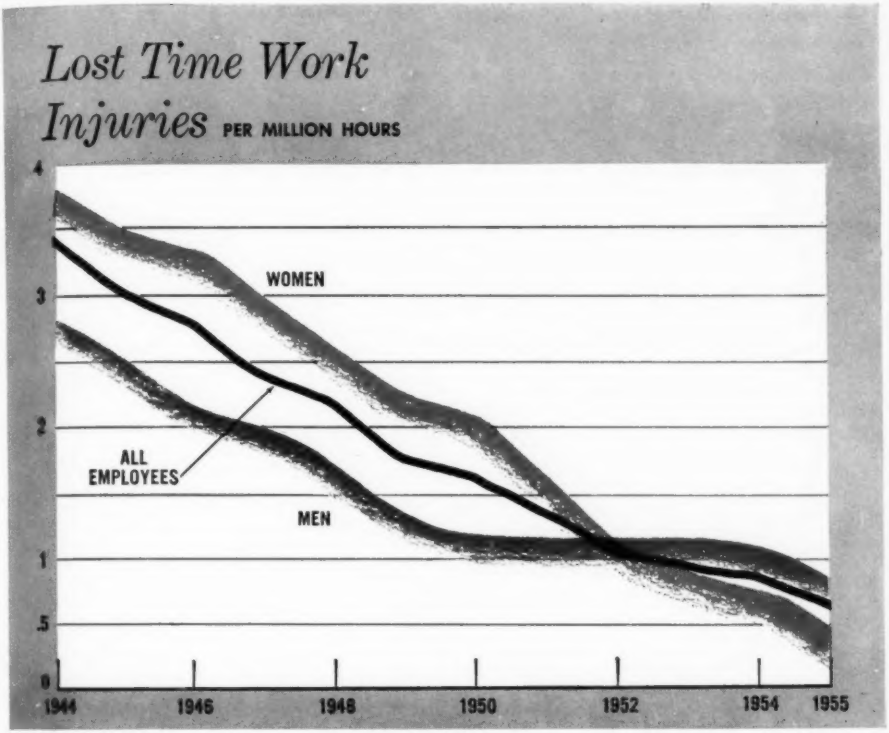


Chart 1

Chart 1 shows the frequency rate of lost-time injuries for all Bell System employees. There has been a significant improvement each year for 12 years in a row. The rate for men shows a general improvement, although from 1951 through 1954 there was little change. In 1955, however, the trend again started downward, and is still favorable.

The improvement for women can be considered outstanding. The injury rate was reduced from 3.60 to .5 (about sevenfold) for each million hours worked.

The improvement for both the men and women just didn't happen. It came about by neither chance nor luck. It came about by good planning of active programs directed at the cause, and by acceptance of the importance of projects such as:

Safety precautions and procedures in Bell System practices;

Company safety codes and practices;

Special training aimed at Safety, including first aid courses;

Visual aids such as motion pictures, film strips, safety graphs, demonstration equipment, and safety posters;

The preparation and study of "How Telephone People Are Injured."

While we are proud of these results, we also are always on the alert to find ways and means for continuing the improvement. We cannot become smug nor complacent. In accident prevention work,

experience has proven that we either improve or lose ground. Once the trend is unfavorable, it becomes a real job to get that trend reversed.

Safety education is the result of long-range planning that cannot be given on a "one-shot" basis. Immunity to accidents is built up over a period of time through experience, training, belief, and interest.

On vs. Off the Job

WHILE THE EXPERIENCE in Chart 1 indicates a nice improvement, it is only a part of the whole picture. In our efforts toward further improvement, we find another interesting comparison by reviewing the data assembled in Chart 2.

This compares our on-the-job with our off-the-job injuries. It is based upon a special study made by five representative Bell companies for the years 1954 and 1955. The low bars represent *on-the-job* injuries resulting in absence of one day or more. The top bars represent *off-the-job* injuries of one day or more occurring to the same group of people. The ratio is higher than 30 to 1. When we stop to think about such a difference, we cannot help but realize that it should be of considerable concern to us.

Expanding the picture a little more, we find similar ratios when comparisons of fatalities are made. In 1953, 14 fatalities occurred on the job and 179 off the job; during 1954, 15 occurred on the job and 190 off the job; and in 1955, 13 occurred on the job as compared with 160 off the job. This ratio of 12 to 1, while not as high as the lost-time injury ratio, is an alarming one. It raises the question, "What kind of impact do our safety programs have on our employees?" Should it be so — that em-

Sincere interest in the safety program on the part of top officials is essential to effective communication. Here the president of a Bell operating company discusses off-duty accidents with management people

An operating company president and vice presidents and general managers review the results of the company-wide safety program

ployees are safer on the job than they are off the job?

Granted that people are on the job only 40 to 45 hours per week, when one considers the time at work, asleep, and on other activities, it seems reasonable to believe that right here is where a lot of attention is required. When a person is injured, the loss in money and human welfare is there irrespective of where the accident occurred.

Continuing the analysis, there is another interesting comparison in Chart 4. Here we review the lost time injuries to Plant men by underlying causes – as classified by the people investigating the accidents. Only a small percentage are due to Plant conditions – tools, weather conditions, and such physical causes. About 10 percent are due to not planning the work and lack of adequate supervision. Almost 70 percent are due to failure to follow safe working practices and procedures which are generally understood and accepted. The percentages of injuries due to human causes have not varied materially during any of the last several years.

A summary of the above analysis brings out that there has been good progress. We have come a long way. Yet our job is not done; for when we expand the picture, we find a high ratio of injuries off the job in comparison with those on the job, and about 12 times as many fatal injuries occur off the job as on the job. We all agree they are just as serious – wherever they happen. As already noted, 70 percent of the injuries are caused by not following safe working practices and procedures which are generally understood and accepted. I believe if we ask ourselves, "Are we reaching our people with our accident preven-

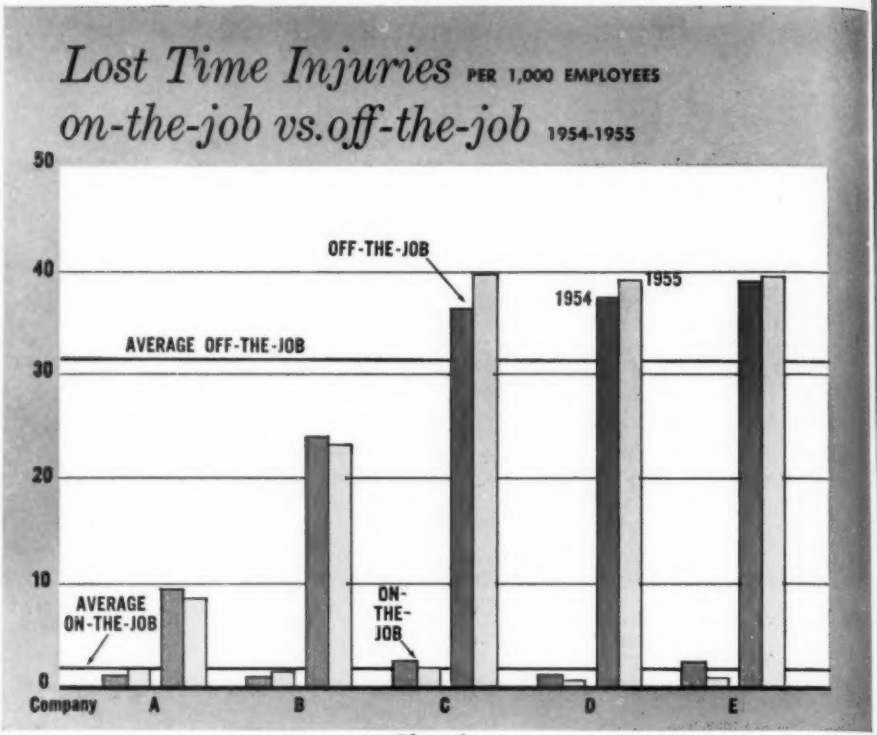


Chart 2

tion programs?" our answer might be that we are not reaching them to the extent that we should. Otherwise, the good performance and the philosophy of the "Why of Safety" would carry over better to the off-the-job activities. The employees of any company, both management and craft, all have a personal stake in safety. If these people get hurt, it doesn't make much difference whether it's an on-the-job or an off-the-job accident. The loss and suffering are the same.

Communicating With People

ONE VERY IMPORTANT requirement for reaching our people, for getting across what we mean to get across, is a good flow of *communications* up and down the line. Safety programs and their results may indicate how good this flow is, for it's by communications that *we get things done through people.* In this expanding economy it is being recognized more and more as an indispensable tool. When certain information must move both up and down the lines of organization, and there is a bottleneck, the message is either lost entirely or it is distorted so that its meaning may be entirely different from what was originally intended.

If we want to use the communication tool effectively, we must plan to gain employees' understanding and belief through such programs as *know your company and its policies and objectives, know your people, build the right atmosphere.*

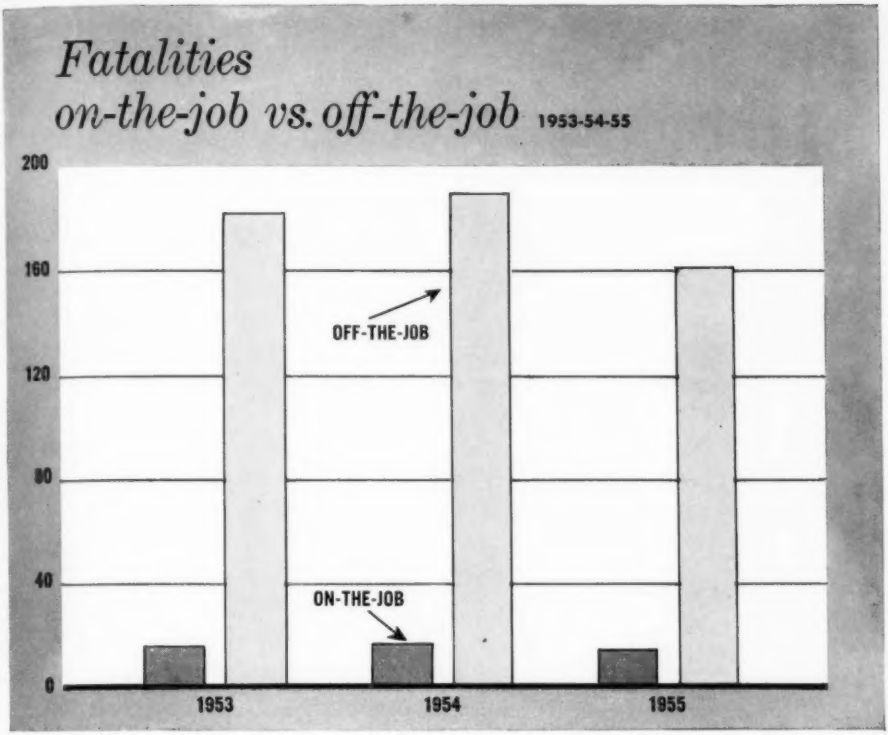


Chart 3

The good results that any company achieves in safety or other operations cannot be looked upon as self-generating or resulting from momentum. These results come from continuous application of human thought and effort – from *good communications and common interests.* When emphasis is placed on a certain project, it is not always necessary to work harder, but only to work *better,* with better tools and methods and planning, and to work together as a team.

An important key to the success or failure of any undertaking is the supervisor and his ability to obtain team effort and then plan the use of this effort effectively.

The supervisor in industry today has many responsibilities. They have to do with production, cost, manpower, safety, morale, and a host of others. Along with the tangibles that are required of him, there are certain human fundamentals that will help him in his broad objective if he will apply them in the right manner.

First of all, the supervisor must set a good example. Safety rules, policies, and practices apply to all employees, not just a special group. For example, stop signs and speed limits are there for the benefit of the individual. The real meaning of accident prevention is not understood if one abides by these rules only while on duty. If a supervisor violates certain policies and practices, whether they pertain to

Meetings such as this are held in one company to develop new safety instructions and introduce them to employees

safety or some other phase of the business, he cannot expect his people to do differently.

Good human relations establish the climate that promotes good attitudes and day-to-day relationships, which in turn work favorably towards the *Safety* objective. For example, it has been pointed out that 70 percent of the accidents are the result of not following safe working practices generally accepted and understood. Many of these accidents happen because the individual is thinking about something other than the job at hand – his thoughts being on other matters to which he attaches importance. They may be about a change that occurred, about his status, about a personal problem at home, or any one of a number of matters. Talking about them with some one lessens and in most cases relieves the tension. Poor human relations become a barrier for this type of communication.

Many times the term *"Human Relations"* and other terms such as *"Communications"* and *"Management Development"* take on a connotation of something new and different. They are not: they have always been with us. It is only now and then that they are brought to light and some additional emphasis is placed on their meaning as a check on "how we are doing." There are some fundamentals that we can all take stock of and review from time to time. Certain principles have been found useful as guides to an understanding of present day "Human Relations" problems. Most of these are simple, but experi-

ence has indicated that these are the very ones most likely to be overlooked.

If, for example, we really want to know what our people think, nothing can take the place of sympathetic listening. This isn't as easy as it sounds. It's only human nature to want to talk rather than listen, especially when we have strong opinions on the subject being discussed. Listening with understanding is the only way we can find out what the individual really thinks.

Demonstrating Management's Interest

THERE IS ALWAYS a lot of discussion of the interest in safety.

It has been said that some management people are not interested in safety – that they are too busy to give it the attention it needs – their attitude being that we've gotten along pretty well so far, so why get concerned about it now. This is not true about management today. There is no one person, management or craft, who can afford to be indifferent to safety, once he knows what it is costing him in money, production, morale, and personal welfare. Some costs are identified by such things as the loss of time, medical expense benefits, and damage claims. But there are hidden costs – loss of production, training, experience of the employee – that are not easily measured. And too, the dollar sign cannot be attached to the loss on the human side. Today management knows and recognizes

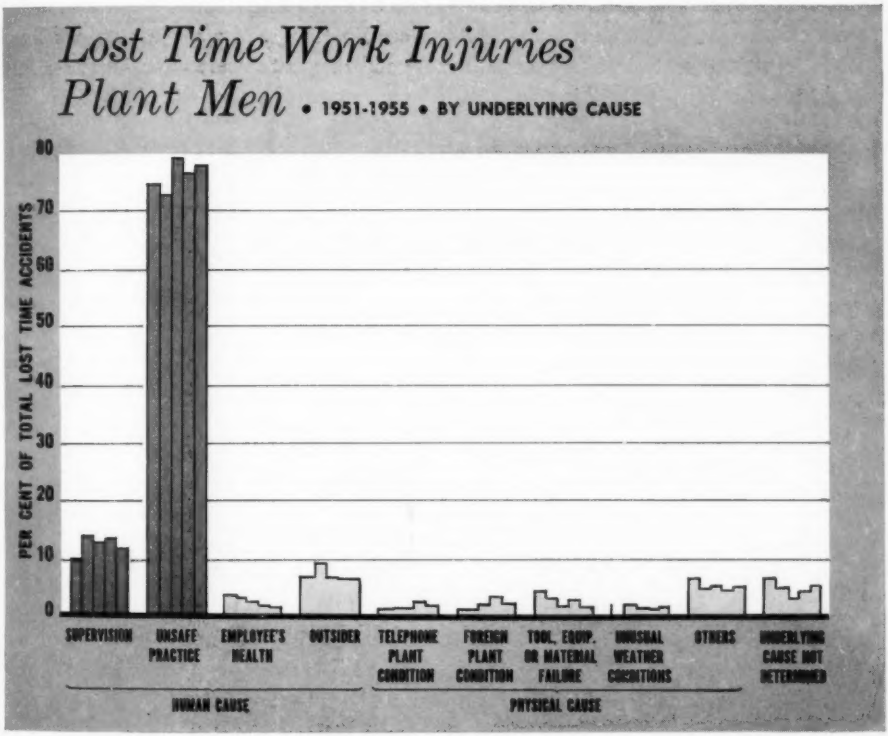


Chart 4

these factors as important, and their interest is high. They know that accident prevention pays — it's the injuries that cost. Part of the job of the staff is to help provide opportunities for all levels of management to demonstrate their interest.

Participation by the group in setting up programs and objectives, whether they are on safety or other phases of our business, has proven to be a successful tool. It implies that those affected by the programs are free to contribute their views, to be given answers to the "why" of certain projects. The skillful supervisor learns from experience that this is the way to win acceptance. If he understands — communications are working in high gear. Participation automatically leads to teamwork, and there is no substitute for teamwork and team effort.

Participation and team effort should not be misinterpreted as squelching individual initiative and performance, nor is it meant that everyone should fall into a pattern. It simply means that the ideas and the pros and cons of an undertaking are considered, so when the final decision is made it is more likely to be the right one.

Let's not go down blind alleys. Let us find out what the problem is, have some kind of report to confirm it, then set up programs designed to cope with it. The programs should be planned with emphasis on timing, the situation, and the group to be reached. The impact of a program depends a great deal on how well it ties in with the interest of the people for whom it is planned.

Also, let us plan the programs with a positive approach. By habit, we are quick to come up with reasons why we cannot do certain things. If a project sounds like a good one, let's search for ideas on "how we *can* do it" rather than "why we can't."

Nearly a million miles without accident draws a company vice president's commendation for these four drivers

Methods of Training

A LOT OF EMPHASIS has been placed on training. We learn by several methods, some of which are:

Through organized classroom sessions;
By experience and association;
By observing;
By reading and other self-developmental procedures.

All of these are used to a certain extent. Some are costly. There must be a balance as to how much organized training can be done. We cannot become so imbued with the idea of training that we are doing it because it happens to be the popular thing at the time. Each session must be evaluated, to insure that it is in line with accomplishing better the over-all objectives of the company.

Management can expose an individual to training sessions, experiences, other factors. How much a person learns and develops depends a great deal on the individual. Everyone is endowed with a certain amount of native ability, but he must apply the energy, drive, initiative, and purposefulness required to bring it out. After being exposed to the basic requirements, individuals are encouraged to program their further training on a self-development basis. For it's only by their individual initiative and ability that they can realize the maximum development of their inherent talents.

The success of good communications and the carrying out of programs successfully depend on how good the day-to-day relationships are. The safety job calls for not only engineering, consulting, and analyzing skills, but salesmanship as well — selling the idea that safety is good business and everyone benefits from safe operations.

Newly developed telephone equipment for receiving alarms and dispatching needed assistance is being installed in municipalities large and small throughout the nation

MUNICIPAL ALARM SYSTEMS SPEED EMERGENCY CALLS

WILLIAM R. GREILING

Industry Study Engineer, COMMERCIAL DIVISION, DEPARTMENT OF OPERATION AND ENGINEERING, A. T. & T. CO.

FIRE! POLICE! AMBULANCE! Those are the cries of distress by which people instinctively voice an urgent need for help—for help usually provided *pronto* by one arm or another of municipal service. In cities and towns everywhere the familiar sound of clanging gong and wailing siren tells how often some emergency arises—and receives response!

Now the Bell System has developed and is providing a major contribution to the further efficiency of this emergency reporting: systems made up of strategically located outdoor emergency telephones connected directly with alerting and dispatching facilities at emergency headquarters.

Twenty-four such systems, varying in size from 12 to 650 street telephones, have thus far been provided for municipalities in the United States and Canada. Under appropriate tariff provisions, installations are now in service in Florida, Indiana, Nebraska, New Jersey, New York, South Dakota, and Ontario, and are being installed in Ohio, Wisconsin, Michigan, Louisiana, and Connecticut.

How do these emergency reporting systems provided by the telephone companies operate? Suppose tonight Mrs. O'Leary's cow, stabled in the traditional barn, should kick over a lantern in a city in which a Bell System emergency reporting installation is in service. If Mrs. O'Leary were to report the fire from the red emergency reporting telephone set located on the nearest corner, the procedure would be something like this. Opening the door of the telephone set by seizing the handle marked PULL gives Mrs. O'Leary access to a familiar telephone handset. Raising the handset from the switch hook immediately connects her with fire headquarters. There audible and visual signals appear at the emergency headquarters switchboard to indicate an incoming call. Once the dispatcher answers, Mrs. O'Leary gives him the what and where of the emergency. Having made the report, Mrs. O'Leary is free to return to the barn and, if possible, extricate her cow.

An emergency telephone nearby brings reassurance in any type of emergency

At the fire headquarters switchboard, the visual signals indicating a call box receiver has been taken off the hook are "locked-in" and can be released only by the dispatcher. If Mrs. O'Leary is too excited to talk, fails to give her address, or replaces the receiver without talking, designation strips above the "locked-in" signal give the location of the emergency telephone Mrs. O'Leary is using. These same designation strips can serve to show what equipment should normally be dispatched to fight a fire reported from the call box in Mrs. O'Leary's neighborhood.

As the dispatcher answering Mrs. O'Leary's call notes the type, extent, and location of the emergency, automatic call recording equipment has printed a permanent record of the date, the code number of the call box Mrs. O'Leary is using and the time of the call. Once the dispatcher knows the location and nature of the fire, he passes the appropriate dispatching information orally to the fire stations which must respond. Teletypewriters connecting fire headquarters with each fire station provide a printed record of the verbal dispatch information.

How much time has elapsed from the moment Mrs. O'Leary raised the handset until the first piece of fire fighting equipment rolled out of the fire station headed for Mrs. O'Leary's barn? In the Syracuse, New York, emergency reporting installation, for example, the average is less than sixty seconds.

Sixty seconds is also a significant time interval for another reason. Every sixty seconds—once each minute of the day and night—another destructive fire somewhere in the United States takes its terrible toll in life and property. Fire losses for the month of March of this year alone are estimated at more than $89,000,000—almost $3,000,000 per day, over $2,000 a minute. In addition to this property loss, the cost

At this fire department communication center, members of the dispatch team answer emergency calls, dispatch equipment, and transmit teletyped confirmation of alarm and dispatch data

in human lives is appalling. Over 12,000 men, women, and children die as the result of fires in the United States each year.

These destructive fires, which take such grim toll in human life and property, are reported to fire headquarters in several ways. In the average city, more than two-thirds are reported over regular exchange telephones in private homes or business establishments—primarily because of the general availability of such telephones. A small number are reported by individuals who carry the message direct to the nearest fire station. The remainder, in most cities, are reported by private citizens over public alarm systems which signal the fact of a fire's existence and general location.

Although a growing proportion of emergencies have been reported from regular exchange telephones, public alarm systems are still of great importance as a method of reporting emergencies when other means of communication are not conveniently available. With the inclusion of voice reporting, they will become increasingly so.

For example, fire, for many years the No. 1 Public Enemy, has been superseded by traffic accidents as the greatest single cause of accidental deaths. A means for reporting such emergencies to the proper authorities swiftly and accurately will assist in holding the number of fatalities from such accidents to a minimum. And, of course, not everyone has a telephone. Even in areas of high residential telephone development, telephones aren't normally accessible to pedestrians late at night and in the early morning hours. In industrial and commercial areas, most premises with telephones are closed at night, and on Sundays and holidays.

Meeting a Growing Need

DURING RECENT YEARS, Bell Companies

have received numerous requests from municipalities to look into the possibility of providing telephone facilities at street locations for use in municipal emergency reporting systems—such systems to embody telephone sets which do not require the deposit of a coin or the use of a dial. Telephones of this type, in addition to their primary purpose—a means for reporting fire orally—would also be used for reporting any other type of emergency.

Early in 1952, at the request of Ben Demby, Superintendent of Communications for the City of Miami, representatives of the Southern Bell Telephone and Telegraph Company, A. T. & T.'s Department of Operation and Engineering, and Bell Telephone Laboratories combined forces to conduct a study of the requirements of a telephone-type emergency reporting system to meet the needs of that city. It was jointly decided that a reporting system based on emergency reporting circuits developed for the military during World War II and modified outdoor telephone sets and P.B.X. switchboards, would be the most expedient method of providing such service.

In August, 1953, the first telephone-type emergency reporting system embodying reliability characteristics of the sort required by the National Board of Fire Underwriters was put into service in Miami, Florida, by the Southern Bell Company.

The system consisted of 282 conventional non-dial outdoor-type telephone sets located at street intersections which usually coincided with traffic control lights. Each telephone was connected by an individual pair of wires to a modified switchboard at fire headquarters. Reporting lines were under continuous electrical test. Visual and audible trouble signals instantly notified the dispatcher of any individual box or line that was out of order. Today there are 325 emergency reporting telephones in service in Miami.

Following the installation of the Miami system, wide interest among municipalities developed, so that other Associated Companies began receiving numerous requests for general information and cost factors from other cities. In addition, the city of Miami has received approximately 15,000 inquiries, from places as far distant as South America, Australia, Africa and Europe.

The System's Advantages

As it became evident that municipalities, industrial concerns, and military establishments felt a need existed for alarm systems using telephone facilities, O. and E. and Bell Telephone Laboratories people, together with the Associated Company people involved, discussed with local authorities their emergency reporting requirements. From these discussions emerged telephone emergency reporting

Teletypewriter facilities are used to send printed confirmation of each alarm, and routine directives to all fire stations

systems which offer the following advantages, aimed at providing a dependable, accurate, fast means for making emergency communications available to everyone who needs help in a hurry:

Utility—In order to dispatch apparatus quickly and in the proper numbers, emergency headquarters must know both the location and the nature of the emergency. Oral reporting makes it possible, in most cases, to determine the exact location of the fire or other emergency and the nature of the help required. For example, in the case of fires not involving buildings—such as automobile fires—only the apparatus and personnel actually needed are dispatched. Other facilities can thus be kept in reserve.

In addition to fire protection, telephone-type emergency reporting systems provide a method of reporting to responsible authorities traffic accidents, calls for police or ambulance, broken water mains, exposed high tension wires, need for emergency inhalators, and many other types of emergency calls. Such systems are also used by foot patrolmen for routine reporting to headquarters and for maintaining contact with proper authorities during emergencies.

Flexibility—Telephone company facilities, which expand with the growth of a municipality, are readily available for providing additional emergency reporting telephones or for the relocation of existing ones. With this flexibility, all sections of a community can be adequately covered as the community and its needs change. Bell System installations also assure modern facilities as newer developments become available.

Maintenance — Installation and maintenance of the alarm system become the responsibility of the telephone company. In case of trouble, skilled repair forces are

Dispatchers at this control center have communication with all agencies needed to respond to any request for emergency assistance. The map behind this switchboard indicates the location and availability of each piece of fire-fighting equipment

dispatched to the scene. Such facilities are especially identified in all telephone exchange offices and cable paths and there is an established program for priority restoration of such vital services. Should emergency conditions necessitate, large reserve forces of maintenance people are available, as are reserve facilities for quick replacement of necessary equipment.

Capital Investment—By obtaining emergency reporting facilities from the telephone companies, the necessary local alarm coverage can be secured without capital investment and at reasonable charges for assured service. As the requirements grow, such systems can be economically extended.

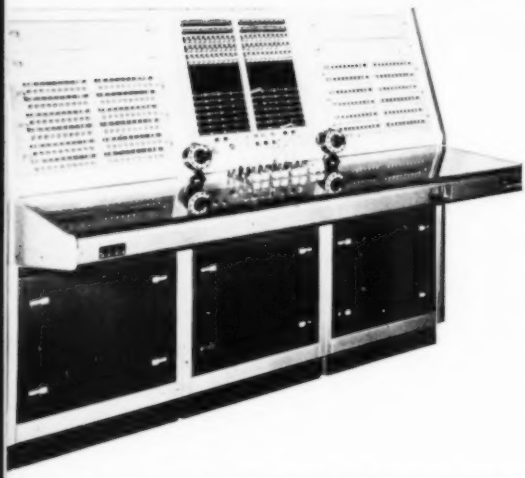
Routine reporting by police officers is a valuable adjunct to municipal emergency reporting systems

Special Equipment

As work on this service progressed, it became increasingly apparent that there would be an advantage in the use of equipment more specifically adapted to emergency reporting systems, in both design and operation, than any then available. Early in 1955 a program was set up for the development of new circuits and switchboard equipment, as well as for an emergency reporting telephone set of distinctive appearance. By the end of that Summer, the Bell System had designed, developed, built, tested, and installed (in Omaha, Nebraska) a new 400-line push-button switchboard, complete with alerting and dispatching facilities; a new emergency reporting line circuit; and a new emergency reporting telephone set.

The new emergency reporting telephone set consists of a cast aluminum housing in which a handset is mounted. A door equipped with a large handle permits easy access to the handset. The all-red housing has the word TELEPHONE cast across the top of the box. The front of these sets is left unsigned to permit application of appropriate signing, usually the words FIRE, POLICE or EMERGENCY, in accordance with the desires of the municipality.

As previously mentioned, one of the most valuable aspects of the telephone-type emergency reporting system is the possibilities it presents for routine reporting of foot patrolmen. In most of the emergency reporting installations to date, calls from emergency reporting telephones destined for the police desk are received at fire alarm headquarters, then transferred to police headquarters over tie lines connecting the two switchboards. The new set includes, however, a non-locking push-button mounted just above the handset. By pushing this button, then lifting the handset, calls can be routed directly to police headquarters, thus by-passing the fire switchboard entirely.



Emergency reporting telephones will now terminate in such modern switchboards

The new emergency reporting switchboard, with a maximum capacity of 400 emergency reporting lines and 20 central office trunks, is designed for operation by either one or two dispatchers. All emergency reporting lines (under continuous electrical test) and central office trunks terminate in the face of the switchboard in both pushbutton-type keys and regular jack appearances.

Pushbutton key terminations enable the dispatcher to "lock in" and answer each call from an emergency reporting telephone by the simple process of depressing the push-button associated with the line. This provides for rapid answering—obviously a desirable feature in handling emergency calls. The additional termination of each line in a jack provides a second method of answering incoming calls, a means of transferring calls when necessary, and the duplicate line lamps considered essential for this type of installation.

Should a number of emergencies necessitate two man operation of the switchboard, the jacks and pushbutton keys are arranged so that each half of the console contains a full appearance of all emergency reporting lines and central office trunks. Thus, each dispatcher is able to answer all incoming calls by using the key and jack appearances on his half of the switchboard.

Another recent important addition to the emergency reporting package is automatic call recording equipment. This automatically prints the box code number, time, and date of each call received from an emergency reporting telephone—thus providing a permanent record of each incoming call.

In any alarm system, availability, speed, accuracy, and reliability are paramount in summoning assistance from call boxes. These same factors are equally important in the alerting and dispatching functions which follow the receipt of emergency reports at alarm headquarters. Let's see what alerting and dispatching equipment the new switchboard provides to meet these qualifications.

Voice retransmission of each alarm from fire headquarters to the fire stations which must respond is normally accomplished by a voice paging system. Depressing the pushbutton key associated with the fire station's voice paging line enables the dispatcher to page any individual station, to call several fire stations at once, or, by pressing the "all-call" pushbutton, to talk to all fire stations simultaneously. Before each message, the dispatcher applies an alerting tone to the selected paging lines.

Printed confirmation of all dispatches may be accomplished over private line teletypewriter facilities which connect fire headquarters with all fire stations. These

teletypewriter installations, provided by the telephone companies, are also useful for disseminating departmental directives and other data, such as information on broken water mains and closed streets.

As fire fighting apparatus is dispatched and pieces of equipment moved in accordance with prearranged plans, dispatchers must know the location and availability of each piece of equipment. "Equipment-status" lamps, which can be provided in the face of the switchboard, give an immediate visual indication of the availability of all such equipment. In the Omaha, Nebraska, and Syracuse, N. Y., installations these status lamps have also been wired so as to provide a duplicate appearance on a map of the city located adjacent to the switchboard.

To help to round out the line of emergency reporting facilities being requested, two additional emergency reporting features are now under development at the Bell Telephone Laboratories.

One is an emergency reporting concentrator which will connect a large number of reporting stations to fire or police headquarters over a small number of trunks from the central office serving the stations. Thus the provision of emergency reporting installations in large cities becomes even more economically attractive. Fire or police dispatchers will be provided with a visual indication of the station number from which the call originates. This equipment will be used for the first time in expanding the New Orleans emergency reporting system during 1957.

A smaller emergency reporting switchboard is being developed for use where ultimate emergency reporting telephone requirements will not warrant the installation of the 400-line switchboard. This switchboard will embody features identical to those of the larger board but will have a maximum capacity of 100 stations.

EMERGENCY REPORTING SYSTEMS are an example of telephone company undertakings dedicated to serving the communication needs of the public. Such systems have speeded both emergency reporting and dispatching, have made these functions more accurate and more efficient, and have enabled the public to call for and receive all types of emergency aid faster than ever before.

HEADQUARTERS SUMMARY

March 15 to June 15, 1956

ON SUNDAY, April 15, San Diego, California, became the first big city in which all customers could dial their own calls directly to millions of other telephones in metropolitan areas from coast to coast.

Through a crossbar tandem, with Centralized Automatic Message Accounting (CAMA) facilities, subscribers have access to 22 foreign numbering-plan areas in addition to most points in their home numbering-plan area.

This is the first system handling calls from both step-by-step and crossbar local offices. Customers in crossbar local offices dial 7 digits for calls to other cities in the home area and 10 digits for calls to foreign areas. Step-by-step users (because there are no "senders" in step offices) must first dial a "112" directing code, followed by the 7 or 10 digits.

Another system which enables all customers in the city to dial directly coast to coast was placed in service at Hartford, Connecticut, on June 17.

A MAJOR ADDITION of coaxial carrier equipment (L3) was placed in service on May 12 between Oakland and Los Angeles. The L3 equipment on this route is installed on 4 of the 8 coaxial conductors in a new cable (not previously equipped for L1 carrier).

One regular and one standby coaxial are equipped in each direction to permit transmission normally on up to 660 telephone channels plus one television channel in each direction. During the Republican Convention, to be held in San Francisco in August, the system will be rearranged to provide two television channels in each direction (on the regular and standby coaxials), in addition to the normal complement of message channels.

The Oakland-Los Angeles system adds approximately 1600 miles of L3-equipped coaxials to the plant and brings the total mileage of L3 carrier in service to about 8200 coaxial miles. Additional projects planned for service by about the end of 1957 are expected to increase this total to about 24000 coaxial miles.

THE New York Telephone Company is currently engaged in a field trial of a photo-sensitive electronic device prepared by the Laboratories which enables a blind attendant to identify lighted switchboard lamps. This "seeing-eye" consists of a photo-electric probe which is attached to a finger of the attendant, and causes an audible signal to be heard when placed in direct view of a lighted lamp. New techniques make it more practicable to "equip" a blind attendant than to equip and modify a P.B.X. for blind operation. The field trial will produce information regarding the accuracy and speed of handling traffic, the problems of maintenance, and other aspects of this new device.

A FIRE in a cable shaft on Friday night, May 4, reduced to a mass of shapeless metal some 7,200 pairs of wires serving the New York Stock Exchange. Plant crews of the New York Telephone Company worked around the clock over the week-end to restore service on what may well be the most intricate communication system of any building in the world.

Telephone men were on the job before the firemen left the building and by Saturday morning about 100 men were working on the restoration of service. Before restoration was completed more than 200 men were involved.

Among the facilities affected were the administrative switchboard, the Exchange's quotation service (which serves 640 private lines and handles an average of 75,000 calls per day) and a large percentage of the 2,000 telephones connected by direct wire to the offices of member firms.

By 9:00 A.M. on Monday, restoration was substantially completed and the Stock Exchange opened for business as scheduled with all necessary communications available.

NEW SCHEDULES for determining settlements with Independent Companies for interchanged message toll telephone business where such settlements are not determined on an individual study basis have been agreed to and recommended for industry use by the United States Independent Telephone Association and Bell System representatives.

These schedules are the result of the most extensive and comprehensive studies ever made of Independent Company costs for

handling interchanged business. Separate schedules are provided for manual, dial terminal-per-line and dial terminal-per-station exchanges—for small and large exchanges—covering the use of local plant and commercial and accounting functions; also manual and dial schedules covering the operating functions. There is also a schedule for line haul provided by Independent Companies which is based on cost and replaces the present plan of prorating the revenue remaining after deduction of settlements for other functions performed.

The estimated effect of the recommended changes will be an increase in the settlements made with Independents of approximately $11 million annually.

SALE OF $250,000,000 A. T. & T. Thirty-Four Year Debentures at competitive bidding on July 10 brings the total new capital added by the Bell System in 1956 to $600,000,000. The Northwestern, Bell of Pennsylvania, New York, and Mountain States Telephone Companies sold bond issues earlier in the year. So far in the post-war period, the System has added about $9½ billion in new capital for its construction program, which is now moving forward at a record level requiring expenditures of over $2 billion a year. After allowing for money provided from internal sources, this program requires about $100,000,000 in new capital per month.

THE HIGHEST PROPORTION of conversions achieved to date for any A. T. & T. issue was attained in the case of the Convertible 3¾s of 1965, which were called for redemption last May. Thanks to a careful follow-up of the original subscribers who were apparently still holders of the issue, to alert them to the advantage of either selling or converting their bonds by the redemption date, only $548,600 of the issue was left unconverted, or less than 1/10 of 1 percent of the $602,543,700 original issue. The best previous result was in the case of the 3½s of 1964 called for redemption on December 15, 1954, which ended with an unconverted balance of $1,505,500 or 0.3%.

GERMANY became on May 7 the first non-English-speaking country in Europe to benefit from a new method of handling overseas service. A modification of so-called "single ticket operation", the changed practice permits the overseas operator to talk directly with the person who answers the distant telephone and to handle all details of the call, instead of relaying information through the inward operator. Since many GI's are in Germany and many local business men who speak English use the service, this time-saving method is feasible. It was first introduced several years ago in connection with Cuban service and then extended to Hawaii, Bermuda, the Bahamas, and the United Kingdom.

THE TJ microwave system now being developed at Bell Telephone Laboratories is undergoing field trial in a two-hop installation over the 42-mile route between Mt. Clemens, Michigan and the A. T. & T. Long Lines' Atlas tower on the Detroit-Saginaw TD-2 system. The TJ system, developed specifically for short-haul toll and television service, will operate in the 10,700-11,700 megacycle band.

CONSIDERABLE ATTENTION has been given recently to the increased use of silicon in semiconducting devices such as transistors and the Bell Solar Battery. The semiconducting properties of silicon are also being profitably used in another less widely known application. A series of diodes for power rectification and numerous other purposes has been developed using silicon as the basic element. The electrical and thermal properties of these devices, as well as their small size, make them ideally suited to a number of applications throughout the Bell System.

PLANS FOR ADDITIONS to two more Western Electric plants brings to more than three million the number of square feet of floor space now under construction or definitely planned by W.E.'s Manufacturing Division. Latest on the list of construction projects is a 140,000 square foot building to be added to the Indianapolis Works and a 480,000 square foot addition to the new Merrimack Valley Plant. Work on the new 900,000 square foot plant in Andover, Mass., which was started in November 1953, is nearing completion, but no date has yet been set for start of the recently announced addition. Also in progress is work on additions to the Point Breeze Works and the Allentown Plant, while plans are being made for the new 1,000,000 square foot manufacturing plant in Omaha, Nebraska, announced earlier this year.

XUM

The Blue Pencil

How about our cover? Does it look bleak, barren, awfully cold around that DEW-Line radar site up there just a bit south of the North Pole? That's the way Robert Geissman, the artist, means it to look. He even executed it in casein because he believes that medium best suited to the effect of frigidity. Incidentally, that's the first of our picture covers that hasn't been done in oils.

Like many commercial illustrators, Mr. Geissman exhibits from time to time at galleries and contemporary shows, and wins his share of prizes. He has just completed two terms as president of the American Society of Illustrators. While he didn't travel to the DEW-Line scene he has represented, he is no stranger to such scenes and circumstances. For during World War II he was art director for the Army Air Force Combat Film Unit, and only last year he received the U. S. Air Force Exceptional Service Award for his work in establishing an art program which is recording the world-wide activities and operations of the U.S.A.F.

Mr. Geissman necessarily worked from photographs, but he had a lot of expert advice too, from various people who had been on the scene of the sites (remind us to tell you later of a pun we know), including, among others, George Turrell.

Remember George? He is the author of "Creation of a Central Office: A Case History," which appeared in the Winter 1955-56 issue of this publication. We shan't forget him; for just when he should have been on hand for consultation, proof reading, and the general responsibilities of authorship, he disappeared on very short notice. He was back again in a little more than a week, with the unassailable excuse that he had just flown about 10,000 miles—from this country to Point Barrow in Alaska, eastward along the whole course of the DEW Line to Baffin Island, and then back home—in the company of W. E. Burke, author of our leading article, who was then project manager of the entire undertaking. He was quite modest about the whole thing, and resumed his proofreading without objection, but it must have seemed like somewhat of an anti-climax.

To anyone who wants more local color—the flavor of what goes on up there in the cold and dark—we commend George's "Five Days on the DEW Line," which appeared in *WE Magazine* for January-February, 1956.

Tales had been filtering back from the Arctic now and then—for not every incident was "classified." There was a lot of kidding about polar bears, but apparently they were a real menace just the same. One yarn we heard reported the bear that entered a cabin through a window momentarily left open. The occupants got out through the door simultaneously —but left bruin as the sole occupant of the room in which the firearms were kept. It was necessary to radio to the next site for reinforcements, which flew in by light plane, before the great beast could be disposed of.

Well, there are other things in these pages than the DEW Line. But before we leave the topic, we must revert to the offer of a few paragraphs back, to commit to paper a pun we have long treasured. (Fair warning. Last exit before the tunnel!) When there dripped from the end of our pencil, spontaneously and without premeditation, that sibilant reference to the scene of the sites, it recalled the ancient account of the peculiar properties of Long Island, where on one side you may see the Sound and on the other side you may hear the sea.

Period.

Let us escape, then, into the more distant past. How long is it since we talked about telephone booths, and asked our readers for notes on same? A long time, surely. Here now is a note from Welland, Ontario—how the Magazine does get around!—with an enclosure which we reprint entire:—

"Driver Picks Wrong
"Phone Booth To Hit

"Sudbury (CP)—After his car crashed into a kiosk-type phone booth, Paul Roy, 22, was surprised to see constable Bill McIntosh climb from the overturned booth. The constable was dialing a number when the car crashed into the booth. He emerged with a bruised arm. Roy was arrested on a careless-driving charge. No one in the auto was injured."

WE HAVE so much enjoyed some of the "commercials" from our *Telephone Hour* radio programs that we tried the other day to quote here some of their kindred announcements from the new TV program *Telephone Time.* It's no go, though. Just a glance at the typewritten script reveals how completely their effectiveness depends on sight as well as sound. Attempts at adapting brought only a mild frustration, and a reluctance to pass up entirely these messages—which set a very high standard, it seems to us, for the "pay off" of all programs of both kinds.

Perhaps we are receptive because the temperature is high today and pre-holiday firecrackers are popping outside our office window; perhaps we are especially moved by this kind of gentle, nostalgic writing. At any rate, for the same reason that we quoted "Growing Time" in last Spring's issue, we now give you "Summertime," from a recent *Telephone Hour* program:

"You can talk all you want about the breath of Spring and all the dewy buds on the trees. Me, I'll take summer. There's a wonderful magic about snow at Christmas, and there's an exciting tang in the smoky Autumn; but, as I said, I'll take summer.

"There's something about lying back on a summer night watching the stars come out that puts you at peace with the world. Somehow you sort of want to count your blessings—to think of all the good things you've had—and all the good people you've known.

"When you think about it that way, you realize that life would have been pretty rough if you hadn't had friends beside you most of the way. Some of 'em you haven't seen for a long time. It would be good just to hear their voices again.

"And you can. No matter where they are in this broad country of ours, you can reach them with a telephone call—and their voices will come to you across the miles. It will enrich your memory just to hear from them again, and it's so little trouble to call—anywhere. It doesn't cost much either. Long distance rates are lower after six, as they are all day Sundays.

"You're never alone when you can telephone. You can share your mood with someone who wants to hear from you. Life is good when you can do that. Especially when the weather is warm, and you can relax—and it's summertime.

"Are you thinking of someone who'd like to hear your voice? Make that call tonight."

LOCAL COLOR
George Turrell at forty degrees below zero

Who's Who & What's What

(Continued from page 67)

president of the A. T. & T. Co.—which Mr. McNeely has been since October of 1955. Starting with the Southwestern Bell Telephone Company as a student engineer in 1922, he held a succession of craft and engineering jobs which led in 25 years to that of general plant manager. In 1948 he became an assistant vice president in A. T. & T.'s Personnel Relations Department; the following year he was elected vice president (Operation) of the Northwestern Bell Telephone Company; and at the end of the year was made that company's president. That is the office he left in 1952 to return to A. T. & T.

PLANT ORGANIZATION AND TRAINING ENGINEER was WILLIAM H. GOODMAN'S title in the A. T. & T. Co. when he wrote "Improved Safety Through Effective Communications" for this issue. But before it could be put to press, he had returned to the Northwestern Bell Telephone Company—

William H. Goodman

William R. Greiling

where he had begun as a telephone man in 1929. He was that company's plant operations supervisor when in 1954 he moved on to the Plant section of A. T. & T.'s Department of Operation and Engineering. Now he goes back to Omaha as assistant vice president—Merchandising.

ANOTHER SHIFT in responsibilities gives WILLIAM R. GREILING the present title of industry study engineer—although when he wrote "Municipal Alarm Systems Speed Emergency Calls" he was a member of the group in the Commercial section of A. T. & T.'s O. & E. Department associated with the development of Bell System Emergency Reporting Systems. He started with the Illinois Bell Telephone Company in 1946, and held Commercial and Engineering positions there until 1954, when he transferred to A. T. & T.

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